THE ASTROPHYSICAL JOURNAL

FOUNDED IN 1895 BY GEORGE E. HALE AND JAMES E. KEELER

Published in Collaboration with the American Astronomical Society

S. CHANDRASEKHAR
Managing Editor

DIMITRI MIHALAS
Associate Editor
University of Chicago

HELMUT A. ABT
Managing Editor
Kitt Peak National Observatory

EDITORIAL BOARD

ALAN H. BARRETT (1971–75)
Massachusetts Institute of Technology

HERBERT FRIEDMAN (1970–74)
U.S. Naval Research Laboratory

MAARTEN SCHMIDT (1969–73)
California Institute of Technology

L. WOLTJER (1968–72)
Columbia University

DONALD E. OSTERBROCK (1967–71)
University of Wisconsin

Production Manager: JEANETTE R. BURNETT

VOLUME 169, PART 1

1971 OCTOBER 1, OCTOBER 15, AND NOVEMBER 1

THE UNIVERSITY OF CHICAGO PRESS
CHICAGO, ILLINOIS

© 1971 BY THE UNIVERSITY OF CHICAGO. ALL RIGHTS RESERVED.
PUBLISHED SEMIMONTHLY

CHICAGO, ILLINOIS, U.S.A.

CONTENTS, PART 1

NUMBER 1

High-Resolution Observations of Compact Radio Sources at 6 and 18 Centimeters
K. I. Kellermann, D. L. Jauncey, M. H. Cohen, B. B. Shaffer, B. G. Clark, J. Broderick, B. Rönnäng, O. E. H. Rydbeck, L. Matveyenko, I. Moiseyev, V. V. Vitkevitch, B. F. C. Cooper, and R. Batchelor 1

A Closer Look at Interstellar Lyman-Alpha Absorption . . Edward B. Jenkins 25

Diffuse Cosmic X-Ray Flux from 0.2 to 2 keV
T. M. Palmieri, G. A. Burginyon, R. J. Grader, R. W. Hill, F. D. Seward, and J. P. Stoering 33

Foundation of the Theory of Cosmic-Ray Transport in Random Magnetic Fields
A. J. Klimas and G. Sandri 41

Radio Emission from Stellar Coronas . . . . . Ludwig Oster 57

Light Curves of Mira Variables at 1.04 Microns
G. W. Lockwood and Robert F. Wing 63

Ionization and Heating of the Gum Nebula by Energetic Particles from the Vela X Supernova . . . . R. Ramaty, E. A. Boldt, S. A. Colgate, and J. Silk 87

Properties of Pulsars . . . G. R. Huguenin, R. N. Manchester, and J. H. Taylor 97

"Bootstrap" Equation of State for Cold Ultradense Matter J. Craig Wheeler 105

An Analytic Approach to the Evolution of Degenerate Carbon Cores of Stars
W. David Arnett 113

The Stability of Supermassive Disks against Fragmentation
William J. Quirk and Christopher F. McKee 119

Theoretical Frameworks for Testing Relativistic Gravity. III. Conservation Laws, Lorentz Invariance, and Values of the PPN Parameters
Clifford M. Will 125

Relativistic Gravity in the Solar System. II. Anisotropy in the Newtonian Gravitational Constant . . . . . Clifford M. Will 141

Line Transfer in the Presence of Two-dimensional Velocity Gradients
C. J. Cannon and D. E. Rees 157

The Radial Electric Field in the Solar Wind . . S. Cuperman and A. Harten 165

The Spectrum of Jupiter at Millimeter Wavelengths
G. T. Wrixon, W. J. Welch, and D. D. Thornton 171

Satellite Bands of the γ'-System of Titanium Oxide . . . . John G. Phillips 185

NOTES

On the Use of Linear Interpolation in Opacity Tables . . Robert T. Rood 191

Spectroscopic Observations of VY Canis Majoris during 1969–1971
George Wallerstein 195

LINE INTENSITIES IN NGC 7027 . . . J. B. Kaler, S. J. Czyzak, and L. H. Aller 199

THE DENSITY OF INTERGALACTIC DUST: AN UPPER LIMIT
Bruce G. Nickerson and R. B. Partridge 203

SEARCH FOR EXTRAGALACTIC H_2O . . . Dale F. Dickinson and Eric J. Chaisson 207

NUMBER 2

ENERGY DISTRIBUTIONS AND *K*-CORRECTIONS FOR THE TOTAL LIGHT FROM GIANT ELLIPTICAL GALAXIES . . . . . R. Schild and J. B. Oke 209

ABSOLUTE ENERGY CURVES AND *K*-CORRECTIONS FOR GIANT ELLIPTICAL GALAXIES
A. E. Whitford 215

DAILY AND HOURLY VARIATIONS IN FLUX DENSITY OF RADIO SOURCES
Beverley J. Wills 221

A 21-CENTIMETER STUDY OF THE SPIRAL GALAXY MESSIER 33 . . Kurtiss J. Gordon 235

KINEMATIC PROPERTIES OF SEVENTY-ONE H II REGIONS IN THE LARGE MAGELLANIC CLOUD
Malcolm G. Smith and Daniel W. Weedman 271

A SEARCH FOR LIGHT VARIATIONS IN SOME SUPERGIANTS IN THE LARGE MAGELLANIC CLOUD . . . . . Jeffrey D. Rosendhal and Michael S. Snowden 281

IMPORTANCE OF THE INTERNAL VELOCITY FIELD IN STAR FORMATION . Thomas Arny 289

INTERPRETATION OF RECOMBINATION-LINE EMISSION FROM THE INTERSTELLAR MEDIUM
Catherine J. Cesarsky and Diego A. Cesarsky 293

THE ORIGIN OF FLUORINE, SODIUM, AND ALUMINUM IN THE GALACTIC COSMIC RADIATION
Brian G. Cartwright 299

ON THE MASSES, LUMINOSITIES, AND COMPOSITIONS OF HORIZONTAL-BRANCH STARS
T. S. van Albada and Norman Baker 311

MODELS FOR THE ENVELOPES OF Be STARS. III. POLE-ON STARS
J. M. Marlborough and J.-Rene Roy 327

A RADIATIVE-TRANSFER MODEL OF A CEPHEID
Janet E. Bendt and Cecil G. Davis, Jr. 333

ATMOSPHERIC ABUNDANCES IN THE BETA CEPHEI STARS . . . . . R. D. Watson 343

STEPLIKE CHANGES IN THE LONG-TERM MODULATION OF COSMIC RAYS
P. H. Stoker and Hugh Carmichael 357

CONVERSION OF MAGNETIC-FIELD ENERGY INTO KINETIC ENERGY IN THE SOLAR WIND
Y. C. Whang 369

PROCESSES OF MAGNETIC-ENERGY CONVERSION AND SOLAR FLARES
Bruno Coppi and Allan B. Friedland 379

ON THE CLASSIFICATION OF SOME HIGHLY IONIZED IRON AND NICKEL LINES IN THE 200–400 Å REGION OF THE SOLAR SPECTRUM
K. G. Widing, G. D. Sandlin, and Robert D. Cowan 405

THE PHOTODISINTEGRATION RATE OF ^{24}Mg . . . . . R. G. Couch and K. C. Shane 413

STELLAR RATES FOR THE $^{28}Si(\alpha,\gamma)^{32}S$ AND $^{16}O(\alpha,\gamma)^{20}Ne$ REACTIONS
James W. Toevs, William A. Fowler, C. A. Barnes, and Peter B. Lyons 421

ON THE OSCILLATOR STRENGTHS OF THE $3s\ ^2S$–$4p\ ^2P$ AND $3d\ ^2D$–$4p\ ^2P$ TRANSITIONS IN SODIUMLIKE IONS . . . . . H.-J. Kunze and R. U. Datla 425

LABORATORY MEASUREMENT OF THE 6-CENTIMETER FORMALDEHYDE TRANSITIONS
K. D. Tucker, G. R. Tomasevich, and P. Thaddeus 429

NOTES

Radiation Pressure and Accelerating Stellar Winds . . J. M. Marlborough 441

Analogue of the Primary Solar Reaction . . . . . John E. Brolley 443

ABSTRACTS OF ASTROPHYSICAL JOURNAL SUPPLEMENT SERIES

Rectangular Coordinates of Rich Clusters of Galaxies on the *Palomar Sky Survey* Charts . . . . . Gummuluru N. Sastry and Herbert J. Rood 445

ERRATA

Radiative Transfer in an Ionized Medium at High Temperature E. D. Loh and G. P. Garmire 447

Studies of Jupiter's Equatorial Thermal Limb Darkening during the 1965 Apparition . . . . . Robert L. Wildey and Laurence M. Trafton 447

NUMBER 3

On the Interpretation of the Hα Profile of the Seyfert Galaxy NGC 5548 Kurt S. Anderson 449

Collective Instabilities and Waves for Inhomogeneous Stellar Systems. II. The Normal-Modes Problem of the Self-consistent Plane-parallel Slab James W-K. Mark 455

A Dynamic Equation for Stochastic Magnetic Field Lines in the Galaxy Frank C. Jones 477

Microsecond Intensity Variations in the Radio Emissions from CP 0950 T. H. Hankins 487

Radiofrequency Detection of an Anomalous Interstellar Recombination Line Eric J. Chaisson and John A. Ball 495

Suprathermal Proton Bremsstrahlung by the Weizsäcker-Williams Method Frank C. Jones 503

Excitation Temperatures of the 18-Centimeter OH Transitions in an Absorbing Cloud . . . . . R. N. Manchester and M. A. Gordon 507

X-Rays from Puppis A and the Vicinity of Vela X F. D. Seward, G. A. Burginyon, R. J. Grader, R. W. Hill, T. M. Palmieri, and J. P. Stoering 515

Am Stars as Possible Members of Two Subgroups of the Scorpius-Centaurus Association . . . . . John W. Glaspey 525

Energy Distributions and Spectra of Orion B Stars Rudolph E. Schild and Frederic Chaffee 529

The Spectrum of LkHα-101 in the Near-Infrared . . . . . G. H. Herbig 537

Two Young Bright Infrared Objects . . . . Martin Cohen and N. J. Woolf 543

Some Double-Lined Eclipsing Binaries with Metallic-Line Spectra Daniel M. Popper 549

Effective Temperature, Radius, and Gravitational Redshift of Sirius B J. L. Greenstein, J. B. Oke, and H. L. Shipman 563

On the Oscillations of a Magnetic Polytrope S. K. Trehan and Dana F. Billings 567

ELEMENT PRODUCTION IN SIMPLE HELIUM BURNING . . . . . Carl J. Hansen 585

SPECTRAL GEOMETRIC ALBEDO OF THE GALILEAN SATELLITES, 0.3 TO 2.5 MICRONS
Torrence V. Johnson and Thomas B. McCord 589

ROCKET OBSERVATIONS OF THE ULTRAVIOLET SOLAR SPECTRUM DURING THE TOTAL ECLIPSE OF 1970 MARCH 7
A. H. Gabriel, W. R. S. Garton, L. Goldberg, T. J. L. Jones, Carole Jordan, F. J. Morgan, R. W. Nicholls, W. J. Parkinson, H. J. B. Paxton, E. M. Reeves, C. B. Shenton, R. J. Speer, and R. Wilson 595

EFFECT UPON OCCULTATIONS OF LUNAR SURFACE STRUCTURE ALONG THE LINE OF SIGHT
Paul Murdin 615

A NEW LOOK AT THE LABORATORY MICROWAVE SPECTRUM OF CYANOACETYLENE
Donald R. Johnson and Frank Lovas 617

COLLISION BROADENING BY NEUTRAL HYDROGEN . . . . . Keith A. Brueckner 621

ABSTRACTS OF ASTROPHYSICAL JOURNAL SUPPLEMENT SERIES

K-LINE PHOTOMETRY OF SOUTHERN A STARS Richard C. Henry and James E. Hesser 633

K-LINE PHOTOMETRY OF STARS IN POPULATION I CLUSTERS
James E. Hesser and Richard C. Henry 633

ADDENDUM

THE SYNTHESIS OF CLOSE-BINARY LIGHT CURVES. II. DOUBLE DISTORTION AND THE SYSTEMS AS ERIDANI, LAMBDA TAURI, AND RS VULPECULAE
J. B. Hutchings and Graham Hill 635

ERRATUM

EFFECTS OF COLLISIONAL EXCITATION ON THE INTENSITIES OF THE 5876 Å AND 4471 Å LINES OF NEUTRAL HELIUM . . . . Donald P. Cox and Enrique Daltabuit 635

INDEX TO VOLUME 169, PART 1 637

INDEX TO VOLUME 169, PART 1

Absolute Energy Curves and *K*-Corrections for Giant Elliptical Galaxies (Whitford), 215.
Aller, L. H. *See* Kaler, Czyzak, and Aller.
Am Stars as Possible Members of Two Subgroups of the Scorpius-Centaurus Association (Glaspey), 525.
Analogue of the Primary Solar Reaction (Brolley), 443.
Analytic Approach to the Evolution of Degenerate Carbon Cores of Stars (Arnett), 113.
Anderson, Kurt S. On the Interpretation of the Hα Profile of the Seyfert Galaxy NGC 5548, 449.
Arnett, W. David. An Analytic Approach to the Evolution of Degenerate Carbon Cores of Stars, 113.
Arny, Thomas. Importance of the Internal Velocity Field in Star Formation, 289.
Atmospheric Abundances in the Beta Cephei Stars (Watson), 343.

Baker, Norman. *See* van Albada and Baker.
Ball, John A. *See* Chaisson and Ball.
Barnes, C. A. *See* Toevs, Fowler, Barnes, and Lyons.
Batchelor, R. *See* Kellermann, Jauncey, Cohen, Shaffer, Clark, Broderick, Rönnäng, Rydbeck, Matveyenko, Moiseyev, Vitkevitch, Cooper, and Batchelor.
Bendt, Janet E., and Davis, Cecil G., Jr. A Radiative-Transfer Model of a Cepheid, 333.
Billings, Dana F. *See* Trehan and Billings.
Boldt, E. A., *See* Ramaty, Boldt, Colgate, and Silk.
"Bootstrap" Equation of State for Cold Ultradense Matter (Wheeler), 105.
Broderick, J. *See* Kellermann, Jauncey, Cohen, Shaffer, Clark, Broderick, Rönnäng, Rydbeck, Matveyenko, Moiseyev, Vitkevitch, Cooper, and Batchelor.
Brolley, John E. Analogue of the Primary Solar Reaction, 443.
Brueckner, Keith A. Collision Broadening by Neutral Hydrogen, 621.
Burginyon, G. A. *See* Palmieri, Burginyon, Grader, Hill, Seward, and Stoering.
Burginyon, G. A. *See* Seward, Burginyon, Grader, Hill, Palmieri, and Stoering.

Cannon, C. J., and Rees, D. E. Line Transfer in the Presence of Two-dimensional Velocity Gradients, 157.
Carmichael, Hugh. *See* Stoker and Carmichael.
Cartwright, Brian G. The Origin of Fluorine, Sodium, and Aluminum in the Galactic Cosmic Radiation, 299.
Cesarsky, Catherine J., and Cesarsky, Diego A. Interpretation of Recombination-Line Emission from the Interstellar Medium, 293.
Cesarsky, Diego A. *See* Cesarsky and Cesarsky.
Chaffee, Frederic. *See* Schild and Chaffee.
Chaisson, Eric, J., and Ball, John A. Radiofrequency Detection of an Anomalous Interstellar Recombination Line, 495.
Chaisson, Eric J. *See* Dickinson and Chaisson.
Clark, B. G. *See* Kellermann, Jauncey, Cohen, Shaffer, Clark, Broderick, Rönnäng, Rydbeck, Matveyenko, Moiseyev, Vitkevitch, Cooper, and Batchelor.
Closer Look at Interstellar Lyman-Alpha Absorption (Jenkins), 25.
Cohen, M. H. *See* Kellermann, Jauncey, Cohen, Shaffer, Clark, Broderick, Rönnäng, Rydbeck, Matveyenko, Moiseyev, Vitkevitch, Cooper, and Batchelor.
Cohen, Martin, and Woolf, N. J. Two Young Bright Infrared Objects, 543.

Colgate, S. A. *See* Ramaty, Boldt, Colgate, and Silk.
Collective Instabilities and Waves for Inhomogeneous Stellar Systems. II. The Normal-Modes Problem of the Self-consistent Plane-parallel Slab (Mark), 455.
Collision Broadening by Neutral Hydrogen (Brueckner), 621.
Conversion of Magnetic-Field Energy into Kinetic Energy in the Solar Wind (Whang), 369.
Cooper, B. F. C. *See* Kellermann, Jauncey, Cohen, Shaffer, Clark, Broderick, Rönnäng, Rydbeck, Matveyenko, Moiseyev, Vitkevitch, Cooper, and Batchelor.
Coppi, Bruno, and Friedland, Allan B. Processes of Magnetic-Energy Conversion and Solar Flares, 379.
Couch, R. G., and Shane, K. C. The Photodisintegration Rate of ^{24}Mg, 413.
Cowan, Robert D. *See* Widing, Sandlin, and Cowan.
Cox, Donald P., and Daltabuit, Enrique. Effects of Collisional Excitation on the Intensities of the 5876 Å and 4471 Å Lines of Neutral Helium, 635.
Cuperman, S., and Harten, A. The Radial Electric Field in the Solar Wind, 165.
Czyzak, S. J. *See* Kaler, Czyzak, and Aller.

Daily and Hourly Variations in Flux Density of Radio Sources (Wills), 221.
Daltabuit, Enrique. *See* Cox and Daltabuit.
Datla, R. U. *See* Kunze and Datla.
Davis, Cecil G., Jr. *See* Bendt and Davis.
Density of Intergalactic Dust: An Upper Limit (Nickerson and Partridge), 203.
Dickinson, Dale F., and Chaisson, Eric J. Search for Extragalactic H_2O, 207.
Diffuse Cosmic X-Ray Flux from 0.2 to 2 keV (Palmieri, Burginyon, Grader, Hill, Seward, and Stoering), 33.
Dynamic Equation for Stochastic Magnetic Field Lines in the Galaxy (Jones), 477.

Effect upon Occultations of Lunar Surface Structure along the Line of Sight (Murdin), 615.
Effective Temperature, Radius, and Gravitational Redshift of Sirius B (Greenstein, Oke, and Shipman), 563.
Effects of Collisional Excitation on the Intensities of the 5876 Å and 4471 Å Lines of Neutral Helium (Cox and Daltabuit), 635.
Element Production in Simple Helium Burning (Hansen), 585.
Energy Distributions and *K*-Corrections for the Total Light from Giant Elliptical Galaxies (Schild and Oke), 209.
Energy Distributions and Spectra of Orion B Stars (Schild and Chaffee), 529.
Excitation Temperatures of the 18-Centimeter OH Transitions in an Absorbing Cloud (Manchester and Gordon), 507.

Foundation of the Theory of Cosmic-Ray Transport in Random Magnetic Fields (Klimas and Sandri), 41.
Fowler, William A. *See* Toevs, Fowler, Barnes, and Lyons.
Friedland, Allan B. *See* Coppi and Friedland.

Gabriel, A. H., Garton, W. R. S., Goldberg, L., Jones, T. J. L., Jordan, Carole, Morgan, F. J., Nicholls, R. W., Parkinson, W. J., Paxton, H. J. B., Reeves, E. M., Shenton, C. B., Speer, R. J., and Wilson, R. Rocket Observations of the Ultraviolet Solar Spectrum during the Total Eclipse of 1970 March 7, 595.
Garmire, G. P. *See* Loh and Garmire.
Garton, W. R. S. *See* Gabriel, Garton, Goldberg, Jones, Jordan, Morgan, Nicholls, Parkinson, Paxton, Reeves, Shenton, Speer, and Wilson.
Glaspey, John W. Am Stars as Possible Members of Two Subgroups of the Scorpius-Centaurus Association, 525.

Goldberg, L. *See* Gabriel, Garton, Goldberg, Jones, Jordan, Morgan, Nicholls, Parkinson, Paxton, Reeves, Shenton, Speer, and Wilson.
Gordon, Kurtiss J. A 21-Centimeter Study of the Spiral Galaxy Messier 33, 235.
Gordon, M. A. *See* Manchester and Gordon.
Grader, R. J. *See* Palmieri, Burginyon, Grader, Hill, Seward, and Stoering.
Grader, R. J. *See* Seward, Burginyon, Grader, Hill, Palmieri, and Stoering.
Greenstein, J. L., Oke, J. B., and Shipman, H. L. Effective Temperature, Radius, and Gravitational Redshift of Sirius B, 563.

Hankins, T. H. Microsecond Intensity Variations in the Radio Emissions from CP 0950, 487.
Hansen, Carl J. Element Production in Simple Helium Burning, 585.
Harten, A. *See* Cuperman and Harten.
Henry, Richard C., and Hesser, James E. K-Line Photometry of Southern A Stars, 633.
Henry, Richard C. *See* Hesser and Henry.
Herbig, G. H. The Spectrum of LkHα-101 in the Near-Infrared, 537.
Hesser, James E., and Henry, Richard C. K-Line Photometry of Stars in Population I Clusters, 633.
Hesser, James E. *See* Henry and Hesser.
High-Resolution Observations of Compact Radio Sources at 6 and 18 Centimeters (Kellermann, Jauncey, Cohen, Shaffer, Clark, Broderick, Rönnäng, Rydbeck, Matveyenko, Moiseyev, Vitkevitch, Cooper, and Batchelor), 1.
Hill, Graham. *See* Hutchings and Hill.
Hill, R. W. *See* Palmieri, Burginyon, Grader, Hill, Seward, and Stoering.
Hill, R. W., *See* Seward, Burginyon, Grader, Hill, Palmieri, and Stoering.
Huguenin, G. R., Manchester, R. N., and Taylor, J. H. Properties of Pulsars, 97.
Hutchings, J. B., and Hill, Graham. The Synthesis of Close-Binary Light Curves. II. Double Distortion and the Systems AS Eridani, Lambda Tauri, and RS Vulpeculae, 635.

Importance of the Internal Velocity Field in Star Formation (Arny), 289.
Interpretation of Recombination-Line Emission from the Interstellar Medium (Cesarsky and Cesarsky), 293.
Ionization and Heating of the Gum Nebula by Energetic Particles from the Vela X Supernova (Ramaty, Boldt, Colgate, and Silk), 87.

Jauncey, D. L. *See* Kellermann, Jauncey, Cohen, Shaffer, Clark, Broderick, Rönnäng, Rydbeck, Matveyenko, Moiseyev, Vitkevitch, Cooper, and Batchelor.
Jenkins, Edward B. A Closer Look at Interstellar Lyman-Alpha Absorption, 25.
Johnson, Donald R., and Lovas, Frank. A New Look at the Laboratory Microwave Spectrum of Cyanoacetylene, 617.
Johnson, Torrence V., and McCord, Thomas B. Spectral Geometric Albedo of the Galilean Satellites, 0.3 to 2.5 Microns, 589.
Jones, Frank C. A Dynamic Equation for Stochastic Magnetic Field Lines in the Galaxy, 477.
Jones, Frank C. Suprathermal Proton Bremsstrahlung by the Weizsäcker-Williams Method, 503.
Jones, T. J. L. *See* Gabriel, Garton, Goldberg, Jones, Jordan, Morgan, Nicholls, Parkinson, Paxton, Reeves, Shenton, Speer, and Wilson.
Jordan, Carole. *See* Gabriel, Garton, Goldberg, Jones, Jordan, Morgan, Nicholls, Parkinson, Paxton, Reeves, Shenton, Speer, and Wilson.

K-Line Photometry of Southern A Stars (Henry and Hesser), 633.
K-Line Photometry of Stars in Population I Clusters (Hesser and Henry), 633.

Kaler, J. B., Czyzak, S. J., and Aller, L. H. Line Intensities in NGC 7027, 199.
Kellermann, K. I., Jauncey, D. L., Cohen, M. H., Shaffer, B. B., Clark, B. G., Broderick, J., Rönnäng, B., Rydbeck, O. E. H., Matveyenko, L., Moiseyev, I., Vitkevitch, V. V., Cooper, B. F. C., and Batchelor, R. High-Resolution Observations of Compact Radio Sources at 6 and 18 Centimeters, 1.
Kinematic Properties of Seventy-One H II Regions in the Large Magellanic Cloud (Smith and Weedman), 271.
Klimas, A. J., and Sandri, G. Foundation of the Theory of Cosmic-Ray Transport in Random Magnetic Fields, 41.
Kunze, H.-J., and Datla, R. U. On the Oscillator Strengths of the $3s\ ^2S$–$4p\ ^2P$ and $3d\ ^2D$–$4p\ ^2P$ Transitions in Sodiumlike Ions, 425.

Laboratory Measurement of the 6-Centimeter Formaldehyde Transitions (Tucker, Tomasevich, and Thaddeus), 429.
Light Curves of Mira Variables at 1.04 Microns (Lockwood and Wing), 63.
Line Intensities in NGC 7027 (Kaler, Czyzak, and Aller), 199.
Line Transfer in the Presence of Two-dimensional Velocity Gradients (Cannon and Rees), 157.
Lockwood, G. W., and Wing, Robert F. Light Curves of Mira Variables at 1.04 Microns, 63.
Loh, E. D., and Garmire, G. P. Radiative Transfer in an Ionized Medium at High Temperature, 447.
Lovas, Frank. *See* Johnson and Lovas.
Lyons, Peter B. *See* Toevs, Fowler, Barnes, and Lyons.

McCord, Thomas B. *See* Johnson and McCord.
McKee, Christopher, F. *See* Quirk and McKee.
Manchester, R. N., and Gordon, M. A. Excitation Temperatures of the 18-Centimeter OH Transitions in an Absorbing Cloud, 507.
Manchester, R. N. *See* Huguenin, Manchester, and Taylor.
Mark, James W-K. Collective Instabilities and Waves for Inhomogeneous Stellar Systems. II. The Normal-Modes Problem of the Self-consistent Plane-parallel Slab, 455.
Marlborough, J. M. Radiation Pressure and Accelerating Stellar Winds, 441.
Marlborough, J. M., and Roy, J.-Rene. Models for the Envelopes of Be Stars. III. Pole-on Stars, 327.
Matveyenko, L. *See* Kellermann, Jauncey, Cohen, Shaffer, Clark, Broderick, Rönnäng, Rydbeck, Matveyenko, Moiseyev, Vitkevitch, Cooper, and Batchelor.
Microsecond Intensity Variations in the Radio Emissions from CP 0950 (Hankins), 487.
Models for the Envelopes of Be Stars. III. Pole-on Stars (Marlborough and Roy), 327.
Moiseyev, I. *See* Kellermann, Jauncey, Cohen, Shaffer, Clark, Broderick, Rönnäng, Rydbeck, Matveyenko, Moiseyev, Vitkevitch, Cooper, and Batchelor.
Morgan, F. J. *See* Gabriel, Garton, Goldberg, Jones, Jordan, Morgan, Nicholls, Parkinson, Paxton, Reeves, Shenton, Speer, and Wilson.
Murdin, Paul. Effect upon Occultations of Lunar Surface Structure along the Line of Sight, 615.

New Look at the Laboratory Microwave Spectrum of Cyanoacetylene (Johnson and Lovas), 617.
Nicholls, R. W. *See* Gabriel, Garton, Goldberg, Jones, Jordan, Morgan, Nicholls, Parkinson, Paxton, Reeves, Shenton, Speer, and Wilson.
Nickerson, Bruce G., and Partridge, R. B. The Density of Intergalactic Dust: An Upper Limit, 203.

Oke, J. B. *See* Greenstein, Oke, and Shipman.
Oke, J. B. *See* Schild and Oke.

On the Classification of Some Highly Ionized Iron and Nickel Lines in the 200–400 Å Region of the Solar Spectrum (Widing, Sandlin, and Cowan), 405.
On the Interpretation of the Hα Profile of the Seyfert Galaxy NGC 5548 (Anderson), 449.
On the Masses, Luminosities, and Compositions of Horizontal-Branch Stars (van Albada and Baker), 311.
On the Oscillations of a Magnetic Polytrope (Trehan and Billings), 567.
On the Oscillator Strengths of the $3s\ ^2S$–$4p\ ^2P$ and $3d\ ^2D$–$4p\ ^2P$ Transitions in Sodiumlike Ions (Kunze and Datla), 425.
On the Use of Linear Interpolation in Opacity Tables (Rood), 191.
Origin of Fluorine, Sodium, and Aluminum in the Galactic Cosmic Radiation (Cartwright), 299.
Oster, Ludwig. Radio Emission from Stellar Coronas, 57.

Palmieri, T. M., Burginyon, G. A., Grader, R. J., Hill, R. W., Seward, F. D., and Stoering, J. P. Diffuse Cosmic X-Ray Flux from 0.2 to 2 keV, 33.
Palmieri, T. M. *See* Seward, Burginyon, Grader, Hill, Palmieri, and Stoering.
Parkinson, W. J. *See* Gabriel, Garton, Goldberg, Jones, Jordan, Morgan, Nicholls, Parkinson, Paxton, Reeves, Shenton, Speer, and Wilson.
Partridge, R. B. *See* Nickerson and Partridge.
Paxton, H. J. B. *See* Gabriel, Garton, Goldberg, Jones, Jordan, Morgan, Nicholls, Parkinson, Paxton, Reeves, Shenton, Speer, and Wilson.
Phillips, John G. Satellite Bands of the γ′-System of Titanium Oxide, 185.
Photodisintegration Rate of ^{24}Mg (Couch and Shane), 413.
Popper, Daniel M. Some Double-lined Eclipsing Binaries with Metallic-Line Spectra, 549.
Processes of Magnetic-Energy Conversion and Solar Flares (Coppi and Friedland), 379.
Properties of Pulsars (Huguenin, Manchester, and Taylor), 97.

Quirk, William J., and McKee, Christopher F. The Stability of Supermassive Disks against Fragmentation, 119.

Radial Electric Field in the Solar Wind (Cuperman and Harten), 165.
Radiation Pressure and Accelerating Stellar Winds (Marlborough), 441.
Radiative Transfer in an Ionized Medium at High Temperature (Loh and Garmire), 447.
Radiative-Transfer Model of a Cepheid (Bendt and Davis), 333.
Radio Emission from Stellar Coronas (Oster), 57.
Radiofrequency Detection of an Anomalous Interstellar Recombination Line (Chaisson and Ball), 495.
Ramaty, R., Boldt, E. A., Colgate, S. A., and Silk, J. Ionization and Heating of the Gum Nebula by Energetic Particles from the Vela X Supernova, 87.
Rectangular Coordinates of Rich Clusters of Galaxies on the *Palomar Sky Survey* Charts (Sastry and Rood), 445.
Rees, D. E. *See* Cannon and Rees.
Reeves, E. M. *See* Gabriel, Garton, Goldberg, Jones, Jordan, Morgan, Nicholls, Parkinson, Paxton, Reeves, Shenton, Speer, and Wilson.
Relativistic Gravity in the Solar System. II. Anisotropy in the Newtonian Gravitational Constant (Will), 141.
Rocket Observations of the Ultraviolet Solar Spectrum during the Total Eclipse of 1970 March 7 (Gabriel, Garton, Goldberg, Jones, Jordan, Morgan, Nicholls. Parkinson, Paxton, Reeves, Shenton, Speer, and Wilson), 595.
Rönnäng, B. *See* Kellermann, Jauncey, Cohen, Shaffer, Clark, Broderick, Rönnäng, Rydbeck, Matveyenko, Moiseyev, Vitkevitch, Cooper, and Batchelor.
Rood, Herbert J. *See* Sastry and Rood.
Rood, Robert T. On the Use of Linear Interpolation in Opacity Tables, 191.

Rosendhal, Jeffrey D., and Snowden, Michael S. A Search for Light Variations in Some Supergiants in the Large Magellanic Cloud, 281.
Roy, J.-Rene. *See* Marlborough and Roy.
Rydbeck, O. E. H. *See* Kellermann, Jauncey, Cohen, Shaffer, Clark, Broderick, Rönnäng, Rydbeck, Matveyenko, Moiseyev, Vitkevitch, Cooper, and Batchelor.

Sandlin, G. D. *See* Widing, Sandlin, and Cowan.
Sandri, G. *See* Klimas and Sandri.
Sastry, Gummuluru N., and Rood, Herbert J. Rectangular Coordinates of Rich Clusters of Galaxies on the *Palomar Sky Survey* Charts, 445.
Satellite Bands of the γ'-System of Titanium Oxide (Phillips), 185.
Schild, Rudolph E., and Chaffee, Frederic. Energy Distributions and Spectra of Orion B Stars, 529.
Schild, R., and Oke, J. B. Energy Distributions and *K*-Corrections for the Total Light from Giant Elliptical Galaxies, 209.
Search for Extragalactic H_2O (Dickinson and Chaisson), 207.
Search for Light Variations in Some Supergiants in the Large Magellanic Cloud (Rosendhal and Snowden), 281.
Seward, F. D., Burginyon, G. A., Grader, R. J., Hill, R. W., Palmieri, T. M., and Stoering, J. P. X-Rays from Puppis A and the Vicinity of Vela X, 515.
Seward, F. D. *See* Palmieri, Burginyon, Grader, Hill, Seward, and Stoering.
Shaffer, B. B. *See* Kellermann, Jauncey, Cohen, Shaffer, Clark, Broderick, Rönnäng, Rydbeck, Matveyenko, Moiseyev, Vitkevitch, Cooper, and Batchelor.
Shane, K. C. *See* Couch and Shane.
Shenton, C. B. *See* Gabriel, Garton, Goldberg, Jones, Jordan, Morgan, Nicholls, Parkinson, Paxton, Reeves, Shenton, Speer, and Wilson.
Shipman, H. L. *See* Greenstein, Oke, and Shipman.
Silk, J. *See* Ramaty, Boldt, Colgate, and Silk.
Smith, Malcolm G., and Weedman, Daniel W. Kinematic Properties of Seventy-One H II Regions in the Large Magellanic Cloud, 271.
Snowden, Michael S. *See* Rosendhal and Snowden.
Some Double-lined Eclipsing Binaries with Metallic-Line Spectra (Popper), 549.
Spectral Geometric Albedo of the Galilean Satellites, 0.3 to 2.5 Microns (Johnson and McCord), 589.
Spectroscopic Observations of VY Canis Majoris during 1969–1971 (Wallerstein), 195.
Spectrum of Jupiter at Millimeter Wavelengths (Wrixon, Welch, and Thornton), 171.
Spectrum of LkHα-101 in the Near-Infrared (Herbig), 537.
Speer, R. J. *See* Gabriel, Garton, Goldberg, Jones, Jordan, Morgan, Nicholls, Parkinson, Paxton, Reeves, Shenton, Speer, and Wilson.
Stability of Supermassive Disks against Fragmentation (Quirk and McKee), 119.
Stellar Rates for the $^{28}Si(\alpha,\gamma)^{32}S$ and $^{16}O(\alpha,\gamma)^{20}Ne$ Reactions (Toevs, Fowler, Barnes, and Lyons), 421.
Steplike Changes in the Long-Term Modulation of Cosmic Rays (Stoker and Carmichael), 357.
Stoering, J. P. *See* Palmieri, Burginyon, Grader, Hill, Seward, and Stoering.
Stoering, J. P. *See* Seward, Burginyon, Grader, Hill, Palmieri, and Stoering.
Stoker, P. H., and Carmichael, Hugh. Steplike Changes in the Long-Term Modulation of Cosmic Rays, 357.
Studies of Jupiter's Equatorial Thermal Limb Darkening during the 1965 Apparition (Wildey and Trafton), 447.
Suprathermal Proton Bremsstrahlung by the Weizsäcker-Williams Method (Jones), 503.
Synthesis of Close-Binary Light Curves. II. Double Distortion and the Systems AS Eridani, Lambda Tauri, and RS Vulpeculae (Hutchings and Hill), 635.

Taylor, J. H. *See* Huguenin, Manchester, and Taylor.
Thaddeus, P. *See* Tucker, Tomasevich, and Thaddeus.
Theoretical Frameworks for Testing Relativistic Gravity. III. Conservation Laws, Lorentz Invariance, and Values of the PPN Parameters (Will), 125.
Thornton, D. D. *See* Wrixon, Welch, and Thornton.
Toevs, James W., Fowler, William A., Barnes, C. A., and Lyons, Peter B. Stellar Rates for the $^{28}Si(\alpha,\gamma)^{32}S$ and $^{16}O(\alpha,\gamma)^{20}Ne$ Reactions, 421.
Tomasevich, G. R. *See* Tucker, Tomasevich, and Thaddeus.
Trafton, Laurence M. *See* Wildey and Trafton.
Trehan, S. K., and Billings, Dana F. On the Oscillations of a Magnetic Polytrope, 567.
Tucker, K. D., Tomasevich, G. R., and Thaddeus, P. Laboratory Measurement of the 6-Centimeter Formaldehyde Transitions, 429.
21-Centimeter Study of the Spiral Galaxy Messier 33 (Gordon), 235.
Two Young Bright Infrared Objects (Cohen and Woolf), 543.

Van Albada, T. S., and Baker, Norman. On the Masses, Luminosities, and Compositions of Horizontal-Branch Stars, 311.
Vitkevitch, V. V. *See* Kellermann, Jauncey, Cohen, Shaffer, Clark, Broderick, Rönnäng, Rydbeck, Matveyenko, Moiseyev, Vitkevitch, Cooper, and Batchelor.

Wallerstein, George. Spectroscopic Observations of VY Canis Majoris during 1969–1971, 195.
Watson, R. D. Atmospheric Abundances in the Beta Cephei Stars, 343.
Weedman, Daniel W. *See* Smith and Weedman.
Welch, W. J., *See* Wrixon, Welch, and Thornton.
Whang, Y. C. Conversion of Magnetic-Field Energy into Kinetic Energy in the Solar Wind, 369.
Wheeler, J. Craig. "Bootstrap" Equation of State for Cold Ultradense Matter, 105.
Whitford, A. E. Absolute Energy Curves and *K*-Corrections for Giant Elliptical Galaxies, 215.
Widing, K. G., Sandlin, G. D., and Cowan, Robert D. On the Classification of Some Highly Ionized Iron and Nickel Lines in the 200–400 Å Region of the Solar Spectrum, 405.
Wildey, Robert L., and Trafton, Laurence M. Studies of Jupiter's Equatorial Thermal Limb Darkening during the 1965 Apparition, 447.
Will, Clifford M. Relativistic Gravity in the Solar System. II. Anisotropy in the Newtonian Gravitational Constant, 141.
Will, Clifford M. Theoretical Frameworks for Testing Relativistic Gravity. III. Conservation Laws, Lorentz Invariance, and Values of the PPN Parameters, 125.
Wills, Beverley J. Daily and Hourly Variations in Flux Density of Radio Sources, 221.
Wilson, R. *See* Gabriel, Garton, Goldberg, Jones, Jordan, Morgan, Nicholls, Parkinson, Paxton, Reeves, Shenton, Speer, and Wilson.
Wing, Robert F. *See* Lockwood and Wing.
Woolf, N. J. *See* Cohen and Woolf.
Wrixon, G. T., Welch, W. J., and Thornton, D. D. The Spectrum of Jupiter at Millimeter Wavelengths, 171.

X-Rays from Puppis A and the Vicinity of Vela X (Seward, Burginyon, Grader, Hill, Palmieri, and Stoering), 515.

THE ASTROPHYSICAL JOURNAL

FOUNDED IN 1895 BY GEORGE E. HALE AND JAMES E. KEELER

Published in Collaboration with the American Astronomical Society

HELMUT A. ABT
Managing Editor
Kitt Peak National Observatory

DONALD E. OSTERBROCK
Letters Editor
University of Wisconsin

DIMITRI MIHALAS
Associate Editor
University of Chicago

ROBERT C. BLESS and JOHN S. MATHIS
Associate Letters Editors
University of Wisconsin

EDITORIAL BOARD

ALAN H. BARRETT (1971–75)
Massachusetts Institute of Technology

MAARTEN SCHMIDT (1969–73)
California Institute of Technology

HERBERT FRIEDMAN (1970–74)
U.S. Naval Research Laboratory

L. WOLTJER (1968–72)
Columbia University

DONALD E. OSTERBROCK (1967–71)
Washburn Observatory

Production Manager: JEANETTE R. BURNETT

VOLUME 169, PART 2

1971 OCTOBER 1, OCTOBER 15, AND NOVEMBER 1

THE UNIVERSITY OF CHICAGO PRESS
CHICAGO, ILLINOIS

XUM

© 1971 BY THE UNIVERSITY OF CHICAGO. ALL RIGHTS RESERVED.
PUBLISHED SEMIMONTHLY

COMPOSED AND PRINTED BY THE UNIVERSITY OF CHICAGO PRINTING DEPARTMENT
CHICAGO, ILLINOIS, U.S.A.

XUM

CONTENTS, PART 2

NUMBER 1

EDITORIAL . . . . . Donald E. Osterbrock L1

PHOTOGRAPHIC DETECTION OF "INTERGALACTIC" MATTER IN THE COMA CLUSTER
Gary A. Welch and G. N. Sastry L3

THE PERIOD-AGE DISTRIBUTION OF PULSARS . . . . . P. A. Sturrock L7

A POSSIBLE INTERPRETATION OF THE PRECURSOR PULSE IN NP 0532 . Franco Pacini L11

THE COMA CLUSTER AS AN X-RAY SOURCE: SOME COSMOLOGICAL IMPLICATIONS
J. Richard Gott III and James E. Gunn L13

X-RAYS FROM A NEW VARIABLE SOURCE GX 1+4
Walter H. G. Lewin, George R. Ricker, and Jeffrey E. McClintock L17

A PULSING X-RAY SOURCE IN CIRCINUS
Bruce Margon, Michael Lampton, Stuart Bowyer, and Ray Cruddace L23

HIGH-RESOLUTION EXTREME-ULTRAVIOLET SOLAR SPECTRUM RECORDED WITH A DIFFRACTION-FILTER SPECTROGRAPH . . . . . W. Schweizer and G. Schmidtke L27

ROCKET-INFRARED FOUR-COLOR PHOTOMETRY OF THE GALAXY'S CENTRAL REGIONS
J. R. Houck, B. T. Soifer, Judith L. Pipher, and Martin Harwit L31

MILLIMETER OBSERVATIONS OF CO, CN, AND CS EMISSION FROM IRC+10216
R. W. Wilson, P. M. Solomon, A. A. Penzias, and K. B. Jefferts L35

MICROWAVE DETECTION OF INTERSTELLAR FORMAMIDE
R. H. Rubin, G. W. Swenson, Jr., R. C. Benson, H. L. Tigelaar, and W. H. Flygare L39

NUMBER 2

EVIDENCE FOR A HIGHLY COMPACT X-RAY SOURCE
Bruce Margon, Stuart Bowyer, Michael Lampton, and Ray Cruddace L45

CORRELATED TRANSIENT SHORT-PERIOD OSCILLATION IN THE OPTICAL AND X-RAY FLUX FROM SCORPIUS X-1 H. Kestenbaum, J. R. P. Angel, R. Novick, and W. J. Cocke L49

EVIDENCE OF HIGH-FREQUENCY OSCILLATIONS IN THE X-RAY FLUX FROM SCORPIUS X-1
J. R. P. Angel, H. Kestenbaum, and R. Novick L57

SPECTRA OF WHITE DWARFS WITH CIRCULAR POLARIZATION
Jesse L. Greenstein, James E. Gunn, and Jerome Kristian L63

HYDROGEN LINE AND CONTINUUM STUDY OF MAFFEI 2 BY RADIO INTERFEROMETRY
G. S. Shostak and L. Weliachew L71

REDUCED HELIUM ABUNDANCES IN NEBULAE
R. R. Robbins, E. Daltabuit, and D. P. Cox L77

A LABORATORY DETERMINATION OF THE FREQUENCY OF THE 10-CENTIMETER RADIO LINE OF CH BY OPTICAL MEASUREMENTS . . . . K. M. Baird and H. Bredohl L83

XUM

NUMBER 3

OHIO RADIO-SOURCE SPECTRA: LIST II
Beverley J. Wills, John D. Kraus, and Bryan H. Andrew L87

GX 349+2 AND GX 340+0: LOCATIONS AND X-RAY PULSATION LIMITS
S. Rappaport, W. Zaumen, R. Doxsey, and W. Mayer L93

X-RAY SOURCES NEAR THE GALACTIC CENTER OBSERVED BY *Uhuru*
E. Kellogg, H. Gursky, S. Murray, H. Tananbaum, and R. Giacconi L99

NEW AMMONIA LINES AND SOURCES IN THE GALAXY
B. Zuckerman, M. Morris, B. E. Turner, and Patrick Palmer L105

OBSERVATIONS OF THE $^2\Pi_{1/2}$, $J = \frac{1}{2}$ LINE OF OH AT 4660 MHz IN SAGITTARIUS B2
F. F. Gardner, J. C. Ribes, and M. W. Sinclair L109

ON THE ABSORPTION OF GAMMA RAYS BY PHOTONS IN PULSARS, QUASI-STELLAR OBJECTS, AND OTHER SOURCE OBJECTS . . J. B. Pollack, P. D. Guthrie, and B. S. P. Shen L113

PHOTOMETRIC OBSERVATIONS OF V1057 CYGNI . . . . Eugenio E. Mendoza V. L117

UPPER LIMIT TO CIRCULAR POLARIZATION OF OPTICAL PULSAR NP 0532
W. J. Cocke, G. W. Muncaster, and T. Gehrels L119

POSITION MEASUREMENTS OF MAIN-LINE OH/INFRARED STARS
Ellen G. Hardebeck and William J. Wilson L123

O I AND H I EMISSIONS FROM THE UPPER ATMOSPHERE OF VENUS
H. W. Moos and G. J. Rottman L127

OPTICAL CHANGES IN ELEVEN OHIO RADIO SOURCES WITH UNUSUAL SPECTRA
G. H. Folsom, A. G. Smith, R. L. Hackney, Karen R. Hackney, and R. J. Leacock L131

INDEX TO VOLUME 169, PART 2 . . . . . L137

INDEX TO VOLUME 169, PART 2

Andrew, Bryan H. *See* Wills, Kraus, and Andrew.
Angel, J. R. P. *See* Kestenbaum, Angel, Novick, and Cocke.
Angel, J. R. P., Kestenbaum, H., and Novick, R. Evidence of High-Frequency Oscillations in the X-Ray Flux from Scorpius X-1, L57.

Baird, K. M., and Bredohl, H. A Laboratory Determination of the Frequency of the 10-Centimeter Radio Line of CH by Optical Measurements, L83.
Benson, R. C. *See* Rubin, Swenson, Benson, Tigelaar, and Flygare.
Bowyer, Stuart. *See* Margon, Bowyer, Lampton, and Cruddace.
Bowyer, Stuart. *See* Margon, Lampton, Bowyer, and Cruddace.
Bredohl, H. *See* Baird and Bredohl.

Cocke, W. J. *See* Kestenbaum, Angel, Novick, and Cocke.
Cocke, W. J., Muncaster, G. W., and Gehrels, T. Upper Limit to Circular Polarization of Optical Pulsar NP 0532, L119.
Coma Cluster as an X-Ray Source: Some Cosmological Implications (Gott and Gunn), L13.
Correlated Transient Short-Period Oscillation in the Optical and X-Ray Flux from Scorpius X-1 (Kestenbaum, Angel, Novick, and Cocke), L49.
Cox, D. P. *See* Robbins, Daltabuit, and Cox.
Cruddace, Ray. *See* Margon, Bowyer, Lampton, and Cruddace.
Cruddace. Ray. *See* Margon, Lampton, Bowyer, and Cruddace.

Daltabuit, E. *See* Robbins, Daltabuit, and Cox.
Doxsey, R. *See* Rappaport, Zaumen, Doxsey, and Mayer.

Editorial (Osterbrock), L1.
Evidence for a Highly Compact X-Ray Source (Margon, Bowyer, Lampton, and Cruddace), L45.
Evidence of High-Frequency Oscillations in the X-Ray Flux from Scorpius X-1 (Angel, Kestenbaum, and Novick), L57.

Flygare, W. H. *See* Rubin, Swenson, Benson, Tigelaar, and Flygare.
Folsom, G. H., Smith, A. G., Hackney, R. L., Hackney, Karen R., and Leacock, R. J. Optical Changes in Eleven Ohio Radio Sources with Unusual Spectra, L131.

Gardner, F. F., Ribes, J. C., and Sinclair, M. W. Observations of the $^2\Pi_{1/2}, J = \frac{1}{2}$ Line of OH at 4660 MHz in Sagittarius B2, L109.
Gehrels, T. *See* Cocke, Muncaster, and Gehrels.
Giacconi, R. *See* Kellogg, Gursky, Murray, Tananbaum, and Giacconi.
Gott, J. Richard, III, and Gunn, James E. The Coma Cluster as an X-Ray Source: Some Cosmological Implications, L13.
Greenstein, Jesse L., Gunn, James E., and Kristian, Jerome. Spectra of White Dwarfs with Circular Polarization, L63.
Gunn, James E. *See* Gott and Gunn.
Gunn, James E. *See* Greenstein, Gunn, and Kristian.
Gursky, H. *See* Kellogg, Gursky, Murray, Tananbaum, and Giacconi.

XUM

Guthrie, P. D. *See* Pollack, Guthrie, and Shen.
GX 349+2 and GX 340+0: Locations and X-Ray Pulsation Limits (Rappaport, Zaumen, Doxsey, and Mayer), L93.

Hackney, Karen R. *See* Folsom, Smith, Hackney, Hackney, and Leacock.
Hackney, R. L. *See* Folsom, Smith, Hackney, Hackney, and Leacock.
Hardebeck, Ellen G., and Wilson, William J. Position Measurements of Main-Line OH/Infrared Stars, L123.
Harwit, Martin. *See* Houck, Soifer, Pipher, and Harwit.
High-Resolution Extreme-Ultraviolet Solar Spectrum Recorded with a Diffraction-Filter Spectrograph (Schweizer and Schmidtke), L27.
Houck, J. R., Soifer, B. T., Pipher, Judith L., and Harwit, Martin. Rocket-Infrared Four-Color Photometry of the Galaxy's Central Regions, L31.
Hydrogen Line and Continuum Study of Maffei 2 by Radio Interferometry (Shostak and Weliachew), L71.

Jefferts, K. B. *See* Wilson, Solomon, Penzias, and Jefferts.

Kellogg, E., Gursky, H., Murray, S., Tananbaum, H., and Giacconi, R. X-Ray Sources near the Galactic Center Observed by *Uhuru*, L99.
Kestenbaum, H. *See* Angel, Kestenbaum, and Novick.
Kestenbaum, H., Angel, J. R. P., Novick, R., and Cocke, W. J. Correlated Transient Short-Period Oscillation in the Optical and X-Ray Flux from Scorpius X-1, L49.
Kraus, John D. *See* Wills, Kraus, and Andrew.
Kristian, Jerome. *See* Greenstein, Gunn, and Kristian.

Laboratory Determination of the Frequency of the 10-Centimeter Radio Line of CH by Optical Measurements (Baird and Bredohl), L83.
Lampton, Michael. *See* Margon, Bowyer, Lampton, and Cruddace.
Lampton, Michael. *See* Margon, Lampton, Bowyer, and Cruddace.
Leacock, R. J. *See* Folsom, Smith, Hackney, Hackney, and Leacock.
Lewin, Walter H. G., Ricker, George R., and McClintock, Jeffrey E. X-Rays from a New Variable Source GX 1+4, L17.

McClintock, Jeffrey E. *See* Lewin, Ricker, and McClintock.
Margon, Bruce, Bowyer, Stuart, Lampton, Michael, and Cruddace, Ray. Evidence for a Highly Compact X-Ray Source, L45.
Margon, Bruce, Lampton, Michael, Bowyer, Stuart, and Cruddace, Ray. A Pulsing X-Ray Source in Circinus, L23.
Mayer, W. *See* Rappaport, Zaumen, Doxsey, and Mayer.
Mendoza V., Eugenio E. Photometric Observations of V1057 Cygni, L117.
Microwave Detection of Interstellar Formamide (Rubin, Swenson, Benson, Tigelaar, and Flygare), L39.
Millimeter Observations of CO, CN, and CS Emission from IRC+10216 (Wilson, Solomon, Penzias, and Jefferts), L35.
Moos, H. W., and Rottman, G. J. O I and H I Emissions from the Upper Atmosphere of Venus, L127.
Morris, M. *See* Zuckerman, Morris, Turner, and Palmer.
Muncaster, G. W. *See* Cocke, Muncaster, and Gehrels.
Murray, S. *See* Kellogg, Gursky, Murray, Tananbaum, and Giacconi.

XUM

New Ammonia Lines and Sources in the Galaxy (Zuckerman, Morris, Turner, and Palmer), L105.
Novick, R. *See* Angel, Kestenbaum, and Novick.
Novick, R. *See* Kestenbaum, Angel, Novick, and Cocke.

Observations of the $^2\Pi_{1/2}$, $J = \frac{1}{2}$ Line of OH at 4660 MHz in Sagittarius B2 (Gardner, Ribes, and Sinclair), L109.
Ohio Radio-Source Spectra: List II (Wills, Kraus, and Andrew), L87.
On the Absorption of Gamma Rays by Photons in Pulsars, Quasi-stellar Objects, and Other Source Objects (Pollack, Guthrie, and Shen), L113.
Optical Changes in Eleven Ohio Radio Sources with Unusual Spectra (Folsom, Smith, Hackney, Hackney, and Leacock), L131.
Osterbrock, Donald E. Editorial, L1.
O I and H I Emissions from the Upper Atmosphere of Venus (Moos and Rottman), L127.

Pacini, Franco. A Possible Interpretation of the Precursor Pulse in NP 0532, L11.
Palmer, Patrick. *See* Zuckerman, Morris, Turner, and Palmer.
Penzias, A. A. *See* Wilson, Solomon, Penzias, and Jefferts.
Period-Age Distribution of Pulsars (Sturrock), L7.
Photographic Detection of "Intergalactic" Matter in the Coma Cluster (Welch and Sastry), L3.
Photometric Observations of V1057 Cygni (Mendoza), L117.
Pipher, Judith L. *See* Houck, Soifer, Pipher, and Harwit.
Pollack, J. B., Guthrie, P. D., and Shen, B. S. P. On the Absorption of Gamma Rays by Photons in Pulsars, Quasi-stellar Objects, and Other Source Objects, L113.
Position Measurements of Main-Line OH/Infrared Stars (Hardebeck and Wilson), L123.
Possible Interpretation of the Precursor Pulse in NP 0532 (Pacini), L11.
Pulsing X-Ray Source in Circinus (Margon, Lampton, Bowyer, and Cruddace), L23.

Rappaport, S., Zaumen, W., Doxsey, R., and Mayer, W. GX 349+2 and GX 340+0: Locations and X-Ray Pulsation Limits, L93.
Reduced Helium Abundances in Nebulae (Robbins, Daltabuit, and Cox), L77.
Ribes, J. C. *See* Gardner, Ribes, and Sinclair.
Ricker, George R. *See* Lewin, Ricker, and McClintock.
Robbins, R. R., Daltabuit, E., and Cox, D. P. Reduced Helium Abundances in Nebulae, L77.
Rocket-Infrared Four-Color Photometry of the Galaxy's Central Regions (Houck, Soifer, Pipher, and Harwit), L31.
Rottman, G. J. *See* Moos and Rottman.
Rubin, R. H., Swenson, G. W., Jr., Benson, R. C., Tigelaar, H. L., and Flygare, W. H. Microwave Detection of Interstellar Formamide, L39.

Sastry, G. N. *See* Welch and Sastry.
Schmidtke, G. *See* Schweizer and Schmidtke.
Schweizer, W., and Schmidtke, G. High-Resolution Extreme-Ultraviolet Solar Spectrum Recorded with a Diffraction-Filter Spectrograph, L27.
Shen, B. S. P. *See* Pollack, Guthrie, and Shen.
Shostak, G. S., and Weliachew, L. Hydrogen Line and Continuum Study of Maffei 2 by Radio Interferometry, L71.
Sinclair, M. W. *See* Gardner, Ribes, and Sinclair.
Smith, A. G. *See* Folsom, Smith, Hackney, Hackney, and Leacock.
Soifer, B. T. *See* Houck, Soifer, Pipher, and Harwit.
Solomon, P. M. *See* Wilson, Solomon, Penzias, and Jefferts.

XUM

Spectra of White Dwarfs with Circular Polarization (Greenstein, Gunn, and Kristian), L63.
Sturrock, P. A. The Period-Age Distribution of Pulsars, L7.
Swenson, G. W., Jr. *See* Rubin, Swenson, Benson, Tigelaar, and Flygare.

Tananbaum, H. *See* Kellogg, Gursky, Murray, Tananbaum, and Giacconi.
Tigelaar, H. L. *See* Rubin, Swenson, Benson, Tigelaar, and Flygare.
Turner, B. E. *See* Zuckerman, Morris, Turner, and Palmer.

Upper Limit to Circular Polarization of Optical Pulsar NP 0532 (Cocke, Muncaster, and Gehrels), L119.

Welch, Gary A., and Sastry, G. N. Photographic Detection of "Intergalactic" Matter in the Coma Cluster, L3.
Weliachew, L. *See* Shostak and Weliachew.
Wills, Beverley J., Kraus, John D., and Andrew, Bryan H. Ohio Radio-Source Spectra: List II, L87.
Wilson, R. W., Solomon, P. M., Penzias, A. A., and Jefferts, K. B. Millimeter Observations of CO, CN, and CS Emission from IRC+10216, L35.
Wilson, William J. *See* Hardebeck and Wilson.

X-Ray Sources near the Galactic Center Observed by *Uhuru* (Kellogg, Gursky, Murray, Tananbaum, and Giacconi), L99.
X-Rays from a New Variable Source GX 1+4 (Lewin, Ricker, and McClintock), L17.

Zaumen, W. *See* Rappaport, Zaumen, Doxsey, and Mayer.
Zuckerman, B., Morris, M., Turner, B. E., and Palmer, Patrick. New Ammonia Lines and Sources in the Galaxy, L105.

XUM

THE ASTROPHYSICAL JOURNAL

FOUNDED IN 1895 BY GEORGE E. HALE AND JAMES E. KEELER

Published in Collaboration with the American Astronomical Society

HELMUT A. ABT
Managing Editor
Kitt Peak National Observatory

DIMITRI MIHALAS
Associate Managing Editor
University of Chicago

EDITORIAL BOARD

ALAN H. BARRETT (1971–75)
Massachusetts Institute of Technology

MAARTEN SCHMIDT (1969–73)
California Institute of Technology

HERBERT FRIEDMAN (1970–74)
U.S. Naval Research Laboratory

L. WOLTJER (1968–72)
Columbia University

DONALD E. OSTERBROCK (1967–71)
University of Wisconsin

Production Manager: JEANETTE R. BURNETT

VOLUME 170, PART 1

1971 NOVEMBER 15, DECEMBER 1, AND DECEMBER 15

THE UNIVERSITY OF CHICAGO PRESS
CHICAGO, ILLINOIS

XUM

© 1971 BY THE UNIVERSITY OF CHICAGO. ALL RIGHTS RESERVED.
PUBLISHED SEMIMONTHLY

CHICAGO, ILLINOIS, U.S.A.

CONTENTS, PART 1

NUMBER 1

EXPANSION ANISOTROPY AND THE SPECTRUM OF THE COSMIC BACKGROUND RADIATION
S. N. Rasband 1

ON THE ABSORPTION-LINE SPECTRUM OF 4C 05.34
John N. Bahcall and Samuel Goldsmith 17

RADIAL VELOCITIES AND LINE STRENGTHS OF EMISSION LINES ACROSS THE NUCLEAR DISK OF M31 . . . . . Vera C. Rubin and W. Kent Ford, Jr. 25

HIGH-SPEED INTERSTELLAR GAS DYNAMICS: SHOCKS MODERATED BY COSMIC RAYS
Donat G. Wentzel 53

FORMATION OF OH THROUGH INVERSE PREDISSOCIATION
P. S. Julienne, M. Krauss, and B. Donn 65

THE MEANING OF THE OH–H_2O MASER MAPS . . . . . M. M. Litvak 71

HIGH-FREQUENCY CONFIRMATION OF A RADIO RECOMBINATION LINE FROM AN H I REGION
Eric J. Chaisson 81

ON THE POSSIBILITY OF PULSAR ACTION IN QUASARS . . . . . P. A. Sturrock 85

N III AND C III EMISSION IN Of STARS . . . . . H. Nussbaumer 93

AN ANALYSIS OF THE IRON SPECTRUM OF FOUR CEPHEIDS . . . Edward G. Schmidt 109

THE ROCHE PROBLEM IN AN ECCENTRIC ORBIT . . . . . A. Nduka 131

NONLINEAR MOTIONS OF ROTATING GASEOUS ELLIPSOIDS . . . . . M. Fujimoto 143

EVOLUTION OF A 0.6 $M_\odot$ WHITE DWARF . . . . . Samuel C. Vila 153

MORE SOLAR MODELS AND NEUTRINO FLUXES . Zulema Abraham and Icko Iben, Jr. 157

PRECISE LABORATORY DETERMINATION OF ROTATIONAL TRANSITION FREQUENCIES IN CYANOACETYLENE . . . . . Robert L. de Zafra 165

SEMIEMPIRICAL CROSS-SECTIONS AND RATES FOR EXCITATION AND FOR IONIZATION OF HYDROGENIC IONS BY ELECTRON IMPACT
Douglas H. Sampson and Lawrence B. Golden 169

ELECTRON-IMPACT CROSS-SECTIONS AND RATES FOR $nl \rightarrow n'l'$ TRANSITIONS IN HYDROGENIC IONS AND HYDROGEN . . . Lawrence B. Golden and Douglas H. Sampson 181

ERRATUM

ABSOLUTE MAGNITUDES OF CEPHEIDS. III . . Allan Sandage and G. A. Tammann 191

NUMBER 2

REDSHIFTS AND ABSOLUTE SPECTRAL ENERGY DISTRIBUTIONS OF GALAXIES IN DISTANT CLUSTERS . . . . . J. B. Oke 193

GROUPS OF GALAXIES: HIDDEN MASS OR QUICK DISINTEGRATION?
George B. Field and William C. Saslaw 199

XUM

THE SMALL-SCALE STRUCTURE OF RADIO GALAXIES AND QUASI-STELLAR SOURCES AT 3.8 CENTIMETERS
M. H. Cohen, W. Cannon, G. H. Purcell, D. B. Shaffer, J. J. Broderick, K. I. Kellermann, and D. L. Jauncey 207

A SEARCH FOR REDSHIFTED NEUTRAL HYDROGEN IN 3C 48 AND OTHER COMPACT OBJECTS
G. A. Seielstad, Bertil Höglund, and Erik Kollberg 219

ON QUASAR EVOLUTION . . . . . A. Cavaliere, P. Morrison, and K. Wood 223

APPARENT ASSOCIATIONS BETWEEN BRIGHT GALAXIES AND QUASI-STELLAR OBJECTS
E. M. Burbidge, G. R. Burbidge, P. M. Solomon, and P. A. Strittmatter 233

GALACTIC WINDS . . . . . William G. Mathews and James C. Baker 241

ON THE MASS AND CHEMICAL COMPOSITION OF CASSIOPEIA A . . Manuel Peimbert 261

COSMIC RAYS IN THE GALAXY: CONVECTION OR DIFFUSION? . . . . John Skilling 265

RELAXATION TIME IN CLUSTERS WITH PAIR CORRELATIONS
E. Manning Butterworth and Richard H. Miller 275

THE ABSENCE OF FORMALDEHYDE RADIATION TOWARD COLD REGIONS OF THE GALACTIC PLANE . . . . . M. A. Gordon and M. S. Roberts 277

ACCURATE POSITION MEASUREMENTS IN THE 1720-MHz LINE OF OH
Ellen G. Hardebeck 281

INTERSTELLAR GAS IN THE DIRECTION OF THE VELA PULSAR
George Wallerstein and Joseph Silk 289

LOWER LIMIT TO THE INTERSTELLAR $^{12}C/^{13}C$ RATIO IN THE DIRECTION OF 20 TAURI
P. Vanden Bout and P. Thaddeus 297

THE GROUND STATE OF MATTER AT HIGH DENSITIES: EQUATION OF STATE AND STELLAR MODELS . . . . . Gordon Baym, Christopher Pethick, and Peter Sutherland 299

ON THE THEORY OF STELLAR WINDS . . . . . B. R. Durney and P. H. Roberts 319

SPECTROSCOPIC STUDIES OF O-TYPE STARS. I. CLASSIFICATION AND ABSOLUTE MAGNITUDES
Peter S. Conti and William R. Alschuler 325

THE VARIATIONS IN BETA CEPHEI STARS . . . . . R. D. Watson 345

$5\mathfrak{M}_\odot$ EVOLUTION FOR POPULATION I COMPOSITIONS . . . . . J. W. Robertson 353

EVOLUTION OF LOW-MASS STARS. IV. EFFECTS OF MULTILEVEL ATOMIC PARTITION FUNCTIONS FOR THE IDEAL-GAS REGION
H. C. Graboske, Jr., and A. S. Grossman 363

FLUX AND POLARIZATION CALCULATIONS OF THE RADIATION REFLECTED FROM THE CLOUDS OF VENUS . . . George W. Kattawar, Gilbert N. Plass, and Charles N. Adams 371

PHOTOIONIZATION CROSS-SECTIONS FOR HELIUM-LIKE POSITIVE IONS
Robert T. Brown 387

ANNOUNCEMENT

Manual of Style for The Astrophysical Journal 393

NUMBER 3

IDENTIFICATION OF THE RYLE-NEVILLE RADIO SOURCES . . . . . M. V. Penston 395

THE ELECTRON-NEUTRINO CROSS-SECTION AND ITS EFFECT ON THE COSMOLOGICAL HELIUM ABUNDANCE . . . . . Hartmut F. Hecht 401

POLARIZATION OF RADIO SOURCES. III. ABSORPTION EFFECTS ON CIRCULAR POLARIZATION IN A SYNCHROTRON SOURCE . . . . . A. G. Pacholczyk and T. L. Swihart 405

THE EVOLUTION OF GALAXIES. I. FORMULATION AND MATHEMATICAL BEHAVIOR OF THE ONE-ZONE MODEL . . . . . Raymond J. Talbot, Jr., and W. David Arnett 409

ON EQUIPARTITION IN GALACTIC NUCLEI AND GRAVITATING SYSTEMS
William C. Saslaw and David S. De Young 423

INTERACTION OF FAST PARTICLES WITH INTERGALACTIC MATTER
Jonathan Arons, Richard McCray, and Joseph Silk 431

THE INFRARED SPECTRUM OF IC 418
R. P. Kovar, A. E. Potter, N. S. Kovar, and L. Trafton 449

NONTHERMAL OH EMISSION IN INTERSTELLAR DUST CLOUDS
B. E. Turner and Carl Heiles 453

COHERENT SYNCHROTRON RADIATION . . . . Peter Goldreich and D. A. Keeley 463

THE GRAVITATIONAL FIELD OF A BOUNDED SOURCE IN GENERAL RELATIVITY
S. Persides 479

PROPERTIES OF HADRON MATTER. II. DENSE BARYON MATTER AND NEUTRON STARS
Y. C. Leung and C. G. Wang 499

FURTHER RADIO OBSERVATIONS OF SCORPIUS X-1
C. M. Wade and R. M. Hjellming 523

A MODEL OF EPSILON AURIGAE . . . . . Robert E. Wilson 529

A COMMENT ON THE INTERPRETATION OF THE BROAD COMPONENT OF N III λλ4634–4640 EMISSION IN Of STARS . . . . . Dimitri Mihalas 541

V605 AQUILAE: A NOVA-LIKE VARIABLE IN AN OLD PLANETARY NEBULA
Holland C. Ford 547

TURBULENCE VELOCITIES IN THE ATMOSPHERE OF ALPHA ORIONIS
Robert B. Hutchison 551

THE STABILITY OF PRECESSING ELLIPTICAL ORBITS IN A SCHWARZSCHILD FIELD
R. O. Hansen 557

PLASMA RADIATION FROM COLLISIONLESS MHD SHOCK WAVES. I. SHOCK-REGION ANALYSIS . . . . . D. F. Smith 559

IRON-LINE EMISSION DURING SOLAR FLARES
G. A. Doschek, J. F. Meekins, R. W. Kreplin, T. A. Chubb, and H. Friedman 573

AN UPPER LIMIT ON THE HARDNESS OF THE NONTHERMAL ELECTRON SPECTRA PRODUCED DURING THE FLASH PHASE OF SOLAR FLARES . . . . . S. R. Kane 587

SOLAR NEUTRINOS. III. COMPOSITION AND MAGNETIC-FIELD EFFECTS AND RELATED INFERENCES . . . . . John N. Bahcall and Roger K. Ulrich 593

THERMALIZATION LENGTHS AND MEAN NUMBERS OF SCATTERINGS FOR LINE PHOTONS
R. Grant Athay and A. Skumanich 605

TRANSFORMS OF THE HYPERGEOMETRIC FUNCTION THAT ALLOW FOR MORE RAPID CONVERGENCE IN CALCULATIONS OF FREE-FREE GAUNT FACTORS . . John T. O'Brien 613

ABSTRACTS OF ASTROPHYSICAL JOURNAL SUPPLEMENT SERIES

THE PARKES SURVEY OF 21-CENTIMETER ABSORPTION IN DISCRETE-SOURCE SPECTRA
I. THE PARKES HYDROGEN-LINE INTERFEROMETER
V. Radhakrishnan, J. W. Brooks, W. M. Goss, J. D. Murray, and U. J. Schwarz 617

II. GALACTIC 21-CENTIMETER OBSERVATIONS IN THE DIRECTION OF 35 EXTRAGALACTIC SOURCES
V. Radhakrishnan, J. D. Murray, Peggy Lockhart, and R. P. J. Whittle 617

III. 21-CENTIMETER ABSORPTION MEASUREMENTS ON 41 GALACTIC SOURCES NORTH OF DECLINATION −48°
V. Radhakrishnan, W. M. Goss, J. D. Murray, and J. W. Brooks 617

IV. 21-CENTIMETER ABSORPTION MEASUREMENTS ON LOW-LATITUDE SOURCES SOUTH OF DECLINATION −46°
W. M. Goss, V. Radhakrishnan, J. W. Brooks, and J. D. Murray 617

V. NOTE ON THE STATISTICS OF ABSORBING H I CONCENTRATIONS IN THE GALACTIC DISK . . . . . V. Radhakrishnan and W. M. Goss 617

ERRATUM

RADIATION FROM A HIGH-TEMPERATURE, LOW-DENSITY PLASMA: THE X-RAY SPECTRUM OF THE SOLAR CORONA . . . . . W. H. Tucker and M. Koren 621

INDEX TO VOLUME 170, PART 1 623

INDEX TO VOLUME 170, PART 1

Abraham, Zulema, and Iben, Icko, Jr. More Solar Models and Neutrino Fluxes, 157.
Absence of Formaldehyde Radiation toward Cold Regions of the Galactic Plane (Gordon and Roberts), 277.
Absolute Magnitudes of Cepheids. III (Sandage and Tammann), 191.
Accurate Position Measurements in the 1720-MHz Line of OH (Hardebeck), 281.
Adams, Charles N. *See* Kattawar, Plass, and Adams.
Alschuler, William R. *See* Conti and Alschuler.
Analysis of the Iron Spectrum of Four Cepheids (Schmidt), 109.
Apparent Associations between Bright Galaxies and Quasi-stellar Objects (Burbidge, Burbidge, Solomon, and Strittmatter), 233.
Arnett, W. David. *See* Talbot and Arnett.
Arons, Jonathan, McCray, Richard, and Silk, Joseph. Interaction of Fast Particles with Intergalactic Matter, 431.
Athay, R. Grant, and Skumanich, A. Thermalization Lengths and Mean Numbers of Scatterings for Line Photons, 605.

Bahcall, John N., and Goldsmith, Samuel. On the Absorption-Line Spectrum of 4C 05.34, 17.
Bahcall, John N., and Ulrich, Roger K. Solar Neutrinos. III. Composition and Magnetic-Field Effects and Related Inferences, 593.
Baker, James C. *See* Mathews and Baker.
Baym, Gordon, Pethick, Christopher, and Sutherland, Peter. The Ground State of Matter at High Densities: Equation of State and Stellar Models, 299.
Broderick, J. J. *See* Cohen, Cannon, Purcell, Shaffer, Broderick, Kellermann, and Jauncey.
Brooks, J. W. *See* Goss, Radhakrishnan, Brooks, and Murray.
Brooks, J. W. *See* Radhakrishnan, Brooks, Goss, Murray, and Schwarz.
Brooks, J. W. *See* Radhakrishnan, Goss, Murray, and Brooks.
Brown, Robert T. Photoionization Cross-Sections for Helium-like Positive Ions, 387.
Burbidge, E. M., Burbidge, G. R., Solomon, P. M., and Strittmatter, P. A. Apparent Associations between Bright Galaxies and Quasi-stellar Objects, 233.
Burbidge, G. R. *See* Burbidge, Burbidge, Solomon, and Strittmatter.
Butterworth, E. Manning, and Miller, Richard H. Relaxation Time in Clusters with Pair Correlations, 275.

Cannon, W. *See* Cohen, Cannon, Purcell, Shaffer, Broderick, Kellermann, and Jauncey.
Cavaliere, A., Morrison, P., and Wood, K. On Quasar Evolution, 223.
Chaisson, Eric J. High-Frequency Confirmation of a Radio Recombination Line from an H I Region, 81.
Chubb, T. A. *See* Doschek, Meekins, Kreplin, Chubb, and Friedman.
Cohen, M. H., Cannon, W., Purcell, G. H., Shaffer, D. B., Broderick, J. J., Kellermann, K. I., and Jauncey, D. L. The Small-Scale Structure of Radio Galaxies and Quasi-stellar Sources at 3.8 Centimeters, 207.
Coherent Synchrotron Radiation (Goldreich and Keeley), 463.
Comment on the Interpretation of the Broad Component of N III λλ4634–4640 Emission in Of Stars (Mihalas), 541.
Conti, Peter S., and Alschuler, William R. Spectroscopic Studies of O-Type Stars. I. Classification and Absolute Magnitudes, 325.
Cosmic Rays in the Galaxy: Convection or Diffusion? (Skilling), 265.

XUM

De Young, David S. *See* Saslaw and De Young.
de Zafra, Robert L. Precise Laboratory Determination of Rotational Transition Frequencies in Cyanoacetylene, 165.
Donn, B. *See* Julienne, Krauss, and Donn.
Doschek, G. A., Meekins, J. F., Kreplin, R. W., Chubb, T. A., and Friedman, H. Iron-Line Emission during Solar Flares, 573.
Durney, B. R., and Roberts, P. H. On the Theory of Stellar Winds, 319.

Electron-Impact Cross-Sections and Rates for $nl \rightarrow n'l'$ Transitions in Hydrogenic Ions and Hydrogen (Golden and Sampson), 181.
Electron-Neutrino Cross-Section and Its Effect on the Cosmological Helium Abundance (Hecht), 401.
Evolution of a 0.6 $M_\odot$ White Dwarf (Vila), 153.
Evolution of Galaxies. I. Formulation and Mathematical Behavior of the One-Zone Model (Talbot and Arnett), 409.
Evolution of Low-Mass Stars. IV. Effects of Multilevel Atomic Partition Functions for the Ideal-Gas Region (Garboske and Grossman), 363.
Expansion Anisotropy and the Spectrum of the Cosmic Background Radiation (Rasband), 1.

Field, George B., and Saslaw, William C. Groups of Galaxies: Hidden Mass or Quick Disintegration?, 199.
5 $\mathfrak{M}_\odot$ Evolution for Population I Compositions (Robertson), 353.
Flux and Polarization Calculations of the Radiation Reflected from the Clouds of Venus (Kattawar, Plass, and Adams), 371.
Ford, Holland C. V605 Aquilae: A Nova-like Variable in an Old Planetary Nebula, 547.
Ford, W. Kent, Jr. *See* Rubin and Ford.
Formation of OH through Inverse Predissociation (Julienne, Krauss, and Donn), 65.
Friedman, H. *See* Doschek, Meekins, Kreplin, Chubb, and Friedman.
Fujimoto, M. Nonlinear Motions of Rotating Gaseous Ellipsoids, 143.
Further Radio Observations of Scorpius X-1 (Wade and Hjellming), 523.

Galactic Winds (Mathews and Baker), 241.
Golden, Lawrence B. *See* Sampson and Golden.
Golden, Lawrence B., and Sampson, Douglas H. Electron-Impact Cross-Sections and Rates for $nl \rightarrow n'l'$ Transitions in Hydrogenic Ions and Hydrogen, 181.
Goldreich, Peter, and Keeley, D. A. Coherent Synchrotron Radiation, 463.
Goldsmith, Samuel. *See* Bahcall and Goldsmith.
Gordon, M. A., and Roberts, M. S. The Absence of Formaldehyde Radiation toward Cold Regions of the Galactic Plane, 277.
Goss, W. M. *See* Radhakrishnan, Brooks, Goss, Murray, and Schwarz.
Goss, W. M. *See* Radhakrishnan and Goss.
Goss, W. M. *See* Radhakrishnan, Goss, Murray, and Brooks.
Goss, W. M., Radhakrishnan, V., Brooks, J. W., and Murray, J. D. The Parkes Survey of 21-Centimeter Absorption in Discrete-Source Spectra. IV. 21-Centimeter Absorption Measurements on Low-Latitude Sources South of Declination −46°, 617.
Graboske, H. C., Jr., and Grossman, A. S. Evolution of Low-Mass Stars. IV. Effects of Multilevel Atomic Partition Functions for the Ideal-Gas Region, 363.
Gravitational Field of a Bounded Source in General Relativity (Persides), 479.
Grossman, A. S. *See* Graboske and Grossman.
Ground State of Matter at High Densities: Equation of State and Stellar Models (Baym, Pethick, and Sutherland), 299.
Groups of Galaxies: Hidden Mass or Quick Distintegration? (Field and Saslaw), 199.

Hansen, R. O. The Stability of Precessing Elliptical Orbits in a Schwarzschild Field, 557.
Hardebeck, Ellen G. Accurate Position Measurements in the 1720-MHz Line of OH, 281.
Hecht, Hartmut F. The Electron-Neutrino Cross-Section and Its Effect on the Cosmological Helium Abundance, 401.
Heiles, Carl. *See* Turner and Heiles.
High-Frequency Confirmation of a Radio Recombination Line from an H I Region (Chaisson), 81.
High-Speed Interstellar Gas Dynamics: Shocks Moderated by Cosmic Rays (Donat G. Wentzel), 53.
Hjellming, R. M. *See* Wade and Hjellming.
Höglund, Bertil. *See* Seielstad, Höglund, and Kollberg.
Hutchison, Robert B. Turbulence Velocities in the Atmosphere of Alpha Orionis, 551.

Iben, Icko, Jr. *See* Abraham and Iben.
Identification of the Ryle-Neville Radio Sources (Penston), 395.
Infrared Spectrum of IC 418 (Kovar, Potter, Kovar, and Trafton), 449.
Interaction of Fast Particles with Intergalactic Matter (Arons, McCray, and Silk), 431.
Interstellar Gas in the Direction of the Vela Pulsar (Wallerstein and Silk), 289.
Iron-Line Emission during Solar Flares (Doschek, Meekins, Kreplin, Chubb, and Friedman), 573.

Jauncey, D. L. *See* Cohen, Cannon, Purcell, Shaffer, Broderick, Kellermann, and Jauncey.
Julienne, P. S., Krauss, M., and Donn, B. Formation of OH through Inverse Predissociation, 65.

Kane, S. R. An Upper Limit on the Hardness of the Nonthermal Electron Spectra Produced during the Flash Phase of Solar Flares, 587.
Kattawar, George W., Plass, Gilbert N., and Adams, Charles N. Flux and Polarization Calculations of the Radiation Reflected from the Clouds of Venus, 371.
Keeley, D. A. *See* Goldreich and Keeley.
Kellermann, K. I. *See* Cohen, Cannon, Purcell, Shaffer, Broderick, Kellermann, and Jauncey.
Kollberg, Erik. *See* Seielstad, Höglund, and Kollberg.
Koren, M. *See* Tucker and Koren.
Kovar, N. S. *See* Kovar, Potter, Kovar, and Trafton.
Kovar, R. P., Potter, A. E., Kovar, N. S., and Trafton, L. The Infrared Spectrum of IC 418, 449.
Krauss, M. *See* Julienne, Krauss, and Donn.
Kreplin, R. W. *See* Doschek, Meekins, Kreplin, Chubb, and Friedman.

Leung, Y. C., and Wang, C. G. Properties of Hadron Matter. II. Dense Baryon Matter and Neutron Stars, 459.
Litvak, M. M. The Meaning of the OH–H_2O Maser Maps, 71.
Lockhart, Peggy. *See* Radhakrishnan, Murray, Lockhart, and Whittle.
Lower Limit to the Interstellar $^{12}C/^{13}C$ Ratio in the Direction of 20 Tauri (Vanden Bout and Thaddeus), 297.

McCray, Richard. *See* Arons, McCray, and Silk.
Manual of Style for The Astrophysical Journal, 393.
Mathews, William G., and Baker, James C. Galactic Winds, 241.
Meaning of the OH–H_2O Maser Maps (Litvak), 71.
Meekins, J. F. *See* Doschek, Meekins, Kreplin, Chubb, and Friedman.
Mihalas, Dimitri. A Comment on the Interpretation of the Broad Component of N III λλ4634–4640 Emission in Of Stars, 541.

XUM

Miller, Richard H. *See* Butterworth and Miller.
Model of Epsilon Aurigae (Wilson), 529.
More Solar Models and Neutrino Fluxes (Abraham and Iben), 157.
Morrison, P. *See* Cavaliere, Morrison, and Wood.
Murray, J. D. *See* Goss, Radhakrishnan, Brooks, and Murray.
Murray, J. D. *See* Radhakrishnan, Brooks, Goss, Murray, and Schwarz.
Murray, J. D. *See* Radhakrishnan, Goss, Murray, and Brooks.
Murray, J. D. *See* Radhakrishnan, Murray, Lockhart, and Whittle.

N III and C III Emission in Of Stars (Nussbaumer), 93.
Nduka, A. The Roche Problem in an Eccentric Orbit, 131.
Nonlinear Motions of Rotating Gaseous Ellipsoids (Fujimoto), 143.
Nonthermal OH Emission in Interstellar Dust Clouds (Turner and Heiles), 453.
Nussbaumer, H. N III and C III Emission in Of Stars, 93.

O'Brien, John T. Transforms of the Hypergeometric Function That Allow for More Rapid Convergence in Calculations of Free-Free Gaunt Factors, 613.
Oke, J. B. Redshifts and Absolute Spectral Energy Distributions of Galaxies in Distant Clusters, 193.
On Equipartition in Galactic Nuclei and Gravitating Systems (Saslaw and De Young), 423.
On Quasar Evolution (Cavaliere, Morrison, and Wood), 223.
On the Absorption-Line Spectrum of 4C 05.34 (Bahcall and Goldsmith), 17.
On the Mass and Chemical Composition of Cassiopeia A (Peimbert), 261.
On the Possibility of Pulsar Action in Quasars (Sturrock), 85.
On the Theory of Stellar Winds (Durney and Roberts), 319.

Pacholczyk, A. G., and Swihart, T. L. Polarization of Radio Sources. III. Absorption Effects on Circular Polarization in a Synchrotron Source, 405.
Parkes Survey of 21-Centimeter Absorption in Discrete Source Spectra. I. The Parkes Hydrogen-Line Interferometer (Radhakrishnan, Brooks, Goss, Murray, and Schwarz, 617.
Parkes Survey of 21-Centimeter Absorption in Discrete-Source Spectra. II. Galactic 21-Centimeter Observations in the Direction of 35 Extragalactic Sources (Radhakrishnan, Murray, Lockhart, and Whittle), 617.
Parkes Survey of 21-Centimeter Absorption in Discrete-Source Spectra. III. 21-Centimeter Absorption Measurements on 41 Galactic Sources North of Declination −48° (Radhakrishnan, Goss, Murray, and Brooks), 617.
Parkes Survey of 21-Centimeter Absorption in Discrete-Source Spectra. IV. 21-Centimeter Absorption Measurements on Low-Latitude Sources South of Declination −46° (Goss, Radhakrishnan, Brooks, and Murray), 617.
Parkes Survey of 21-Centimeter Absorption in Discrete-Source Spectra. V. Note on the Statistics of Absorbing H I Concentrations in the Galactic Disk (Radhakrishnan and Goss), 617.
Peimbert, Manuel. On the Mass and Chemical Composition of Cassiopeia A, 261.
Penston, M. V. Identification of the Ryle-Neville Radio Sources, 395.
Persides, S. The Gravitational Field of a Bounded Source in General Relativity, 479.
Pethick, Christopher. *See* Baym, Pethick, and Sutherland.
Photoionization Cross-Sections for Helium-like Positive Ions (Brown), 387.
Plasma Radiation from Collisionless MHD Shock Waves. I. Shock-Region Analysis (Smith), 559.
Plass, Gilbert N. *See* Kattawar, Plass, and Adams.
Polarization of Radio Sources. III. Absorption Effects on Circular Polarization in a Synchrotron Source (Pacholczyk and Swihart), 405.
Potter, A. E. *See* Kovar, Potter, Kovar, and Trafton.

Precise Laboratory Determination of Rotational Transition Frequencies in Cyanoacetylene (de Zafra), 165.
Properties of Hadron Matter. II. Dense Baryon Matter and Neutron Stars (Leung and Wang), 499.
Purcell, G. H. *See* Cohen, Cannon, Purcell, Shaffer, Broderick, Kellermann, and Jauncey.

Radhakrishnan, V. *See* Goss, Radhakrishnan, Brooks, and Murray.
Radhakrishnan, V., Brooks, J. W., Goss, W. M., Murray, J. D., and Schwarz, U. J. The Parkes Survey of 21-Centimeter Absorption in Discrete-Source Spectra. I. The Parkes Hydrogen-Line Interferometer, 617.
Radhakrishnan, V., and Goss, W. M. The Parkes Survey of 21-Centimeter Absorption in Discrete-Source Spectra. V. Note on the Statistics of Absorbing H I Concentrations in the Galactic Disk, 617.
Radhakrishnan, V., Goss, W. M., Murray, J. D., and Brooks, J. W. The Parkes Survey of 21-Centimeter Absorption in Discrete-Source Spectra. III. 21-Centimeter Absorption Measurements on 41 Galactic Sources North of Declination −48°, 617.
Radhakrishnan, V., Murray, J. D., Lockhart, Peggy, and Whittle, R. P. J. The Parkes Survey of 21-Centimeter Absorption in Discrete-Source Spectra. II. Galactic 21-Centimeter Observations in the Direction of 35 Extragalactic Sources, 617.
Radial Velocities and Line Strengths of Emission Lines across the Nuclear Disk of M31 (Rubin and Ford), 25.
Radiation from a High-Temperature, Low-Density Plasma: The X-Ray Spectrum of the Solar Corona (Tucker and Koren), 621.
Rasband, S. N. Expansion Anisotropy and the Spectrum of the Cosmic Background Radiation, 1.
Redshifts and Absolute Spectral Energy Distributions of Galaxies in Distant Clusters (Oke), 193.
Relaxation Time in Clusters with Pair Correlations (Butterworth and Miller), 275.
Roberts, P. H. *See* Durney and Roberts.
Roberts, M. S. *See* Gordon and Roberts.
Robertson, J. W. 5 $\mathfrak{M}_\odot$ Evolution for Population I Compositions, 353.
Roche Problem in an Eccentric Orbit (Nduka), 131.
Rubin, Vera C., and Ford, W. Kent, Jr. Radial Velocities and Line Strengths of Emission Lines across the Nuclear Disk of M31, 25.

Sampson, Douglas H. *See* Golden and Sampson.
Sampson, Douglas H., and Golden, Lawrence B. Semiempirical Cross-Sections and Rates for Excitation and for Ionization of Hydrogenic Ions by Electron Impact, 169.
Sandage, Allan, and Tammann, G. A. Absolute Magnitudes of Cepheids. III, 191.
Saslaw, William C. *See* Field and Saslaw.
Saslaw, William C., and De Young, David S. On Equipartition in Galactic Nuclei and Gravitating Systems, 423.
Schmidt, Edward G. An Analysis of the Iron Spectrum of Four Cepheids, 109.
Schwarz, U. J. *See* Radhakrishnan, Brooks, Goss, Murray, and Schwarz.
Search for Redshifted Neutral Hydrogen in 3C 48 and Other Compact Objects (Seielstad, Höglund, and Kollberg), 219.
Seielstad, G. A., Höglund, Bertil, and Kollberg, Erik. A Search for Redshifted Neutral Hydrogen in 3C 48 and Other Compact Objects, 219.
Semiempirical Cross-Sections and Rates for Excitation and for Ionization of Hydrogenic Ions by Electron Impact (Sampson and Golden), 169.
Shaffer, D. B. *See* Cohen, Cannon, Purcell, Shaffer, Broderick, Kellermann, and Jauncey.
Silk, Joseph. *See* Arons, McCray, and Silk.

XUM

Silk, Joseph. *See* Wallerstein and Silk.
Skilling, John. Cosmic Rays in the Galaxy: Convection or Diffusion?, 265.
Skumanich, A. *See* Athay and Skumanich.
Small-Scale Structure of Radio Galaxies and Quasi-stellar Sources at 3.8 Centimeters (Cohen, Cannon, Purcell, Shaffer, Broderick, Kellermann, and Jauncey), 207.
Smith, D. F. Plasma Radiation from Collisionless MHD Shock Waves. I. Shock-Region Analysis, 559.
Solar Neutrinos. III. Composition and Magnetic-Field Effects and Related Inferences (Bahcall and Ulrich), 593.
Solomon, P. M. *See* Burbidge, Burbidge, Solomon, and Strittmatter.
Spectroscopic Studies of O-Type Stars. I. Classification and Absolute Magnitudes (Conti and Alschuler), 325.
Stability of Precessing Elliptical Orbits in a Schwarzschild Field (Hansen), 557.
Strittmatter, P. A. *See* Burbidge, Burbidge, Solomon, and Strittmatter.
Sturrock, P. A. On the Possibility of Pulsar Action in Quasars, 85.
Sutherland, Peter. *See* Baym, Pethick and Sutherland.
Swihart, T. L. *See* Pacholczyk and Swihart.

Talbot, Raymond J., Jr., and Arnett, W. David. The Evolution of Galaxies. I. Formulation and Mathematical Behavior of the One-Zone Model, 409.
Tammann, G. A. *See* Sandage and Tammann.
Thaddeus, P. *See* Vanden Bout and Thaddeus.
Thermalization Lengths and Mean Numbers of Scatterings for Line Photons (Athay and Skumanich), 605.
Trafton, L. *See* Kovar, Potter, Kovar, and Trafton.
Transforms of the Hypergeometric Function That Allow for More Rapid Convergence in Calculations of Free-Free Gaunt Factors (O'Brien), 613.
Tucker, W. H., and Koren M. Radiation from a High-Temperature, Low-Density Plasma: The X-Ray Spectrum of the Solar Corona, 621.
Turbulence Velocities in the Atmosphere of Alpha Orionis (Hutchison), 551.
Turner, B. E., and Heiles, Carl. Nonthermal OH Emission in Interstellar Dust Clouds, 453.

Ulrich, Roger K. *See* Bahcall and Ulrich.
Upper Limit on the Hardness of the Nonthermal Electron Spectra Produced during the Flash Phase of Solar Flares (Kane), 587.

V605 Aquilae: A Nova-like Variable in an Old Planetary Nebula (Ford), 547.
Vanden Bout, P., and Thaddeus, P. Lower Limit to the Interstellar $^{12}C/^{13}C$ Ratio in the Direction of 20 Tauri, 297.
Variations in Beta Cephei Stars (Watson), 345.
Vila, Samuel C. Evolution of a 0.6 $M_{\odot}$ White Dwarf, 153.

Wade, C. M., and Hjellming, R. M. Further Radio Observations of Scorpius X-1, 523.
Wallerstein, George, and Silk, Joseph. Interstellar Gas in the Direction of the Vela Pulsar, 289.
Wang, C. G. *See* Leung and Wang.
Watson, R. D. The Variations in Beta Cephei Stars, 345.
Wentzel, Donat G. High-Speed Interstellar Gas Dynamics: Shocks Moderated by Cosmic Rays, 53.
Whittle, R. P. J. *See* Radhakrishnan, Murray, Lockhart, and Whittle.
Wilson, Robert E. A Model of Epsilon Aurigae, 529.
Wood, K. *See* Cavaliere, Morrison, and Wood.

THE ASTROPHYSICAL JOURNAL

FOUNDED IN 1895 BY GEORGE E. HALE AND JAMES E. KEELER

Published in Collaboration with the American Astronomical Society

HELMUT A. ABT
Managing Editor
Kitt Peak National Observatory

DONALD E. OSTERBROCK
Letters Editor
University of Wisconsin

DIMITRI MIHALAS
Associate Editor
University of Chicago

ROBERT C. BLESS and JOHN S. MATHIS
Associate Letters Editors
University of Wisconsin

EDITORIAL BOARD

ALAN H. BARRETT (1971–75)
Massachusetts Institute of Technology

MAARTEN SCHMIDT (1969–73)
California Institute of Technology

HERBERT FRIEDMAN (1970–74)
U.S. Naval Research Laboratory

L. WOLTJER (1968–72)
Columbia University

DONALD E. OSTERBROCK (1967–71)
Washburn Observatory

Production Manager: JEANETTE R. BURNETT

VOLUME 170, PART 2

1971 NOVEMBER 15, DECEMBER 1, AND DECEMBER 15

THE UNIVERSITY OF CHICAGO PRESS
CHICAGO, ILLINOIS

XUM

© 1971 BY THE UNIVERSITY OF CHICAGO. ALL RIGHTS RESERVED.
PUBLISHED SEMIMONTHLY

COMPOSED AND PRINTED BY THE UNIVERSITY OF CHICAGO PRINTING DEPARTMENT
CHICAGO, ILLINOIS, U.S.A.

CONTENTS, PART 2

NUMBER 1

COUNTS OF RADIO SOURCES AT 6-CENTIMETER WAVELENGTH
K. I. Kellermann, M. M. Davis, and I. I. K. Pauliny-Toth L1

IDENTIFICATION OF THE NUCLEUS OF NGC 5128 William E. Kunkel and Hale V. Bradt L7

RADIO EMISSION FROM THE NUCLEUS OF NGC 5128
C. M. Wade, R. M. Hjellming, K. I. Kellermann, and J. F. C. Wardle L11

INFRARED OBSERVATIONS OF THE CORE OF CENTAURUS A, NGC 5128
E. E. Becklin, J. A. Frogel, D. E. Kleinmann, G. Neugebauer, E. P. Ney, and D. W. Strecker L15

FURTHER OBSERVATIONS OF THE PULSATING X-RAY SOURCE CYGNUS X-1 FROM *Uhuru*
E. Schreier, H. Gursky, E. Kellogg, H. Tananbaum, and R. Giacconi L21

VARIABILITY OF RADIATION FROM CIRCUMSTELLAR GRAINS SURROUNDING R CORONAE BOREALIS . . . . . W. J. Forrest, F. C. Gillett, and W. A. Stein L29

THE NATURE OF BECKLIN'S STAR . . M. V. Penston, D. A. Allen, and A. R. Hyland L33

G61−29, A HELIUM EMISSION-LINE STAR . E. M. Burbidge and P. A. Strittmatter L39

A PREDICTION OF THE RATE OF THE $^{12}C(\alpha, \gamma)^{16}O$ REACTION IN HELIUM BURNING
W. David Arnett L43

X-RAY OBSERVATION OF A NEW SOFT SOURCE IN CYGNUS
P. L. Coleman, A. N. Bunner, W. L. Kraushaar, and D. McCammon L47

ANNOUNCEMENT

A MANUAL OF STYLE FOR THE ASTROPHYSICAL JOURNAL L51

NUMBER 2

ON THE CIRCULAR POLARIZATION OF SOME PECULIAR OBJECTS
N. S. Nikulin, V. M. Kuvshinov, and A. B. Severny L53

A SEARCH FOR SPECTRAL FEATURES IN THE SUBMILLIMETER BACKGROUND RADIATION
John C. Mather, Michael W. Werner, and P. L. Richards L59

X-RAY EMISSION FROM THE MAGELLANIC CLOUDS OBSERVED BY *Uhuru*
C. Leong, E. Kellogg, H. Gursky, H. Tananbaum, and R. Giacconi L67

ULTRARAPID ACTIVITY AT Hα IN THE SPECTRA OF Be STARS
J. B. Hutchings, J. R. Auman, A. C. Gower, and G. A. H. Walker L73

RADIO OBSERVATIONS OF MARS AT 8.57 MILLIMETERS
P. M. Kalaghan and L. E. Telford L77

THE HADRON BARRIER IN COSMOLOGY AND GRAVITATIONAL COLLAPSE
John N. Bahcall and Steven Frautschi L81

OBSERVATIONS OF INTERSTELLAR Ca I LINES . . . . . L. M. Hobbs L85

XUM

NUMBER 3

100-Micron Survey of the Galactic Plane
William F. Hoffmann, Carl L. Frederick, and Roger J. Emery L89

Ultrashort-Period Binaries, Gravitational Radiation, and Mass Transfer. I. The Standard Model, with Applications to WZ Sagittae and Z Camelopardalis
John Faulkner L99

Long Wave Trains of Gravitational Waves from a Vibrating Black Hole
William H. Press L105

HCN in IRC+10216 . . M. Morris, B. Zuckerman, Patrick Palmer, and B. E. Turner L109

New Galactic H_2O Sources Associated with H II Regions
B. E. Turner and R. H. Rubin L113

Radiofrequency Recombination Lines as Diagnostics of the Cool Interstellar Medium . . . . . A. K. Dupree L119

Radio Observations of Magnetic White Dwarfs
V. A. Hughes, P. A. Feldman, and A. Woodsworth L125

Abundance Ratios from the Absorption Spectrum of the Quasar PKS 0237−23
F. D. A. Hartwick L127

INDEX TO VOLUME 170, PART 2 . . . . . L131

INDEX TO VOLUME 170, PART 2

Abundance Ratios from the Absorption Spectrum of the Quasar PKS 0237−23 (Hartwick), L127.
Allen, D. A. *See* Penston, Allen, and Hyland.
Arnett, W. David. A Prediction of the Rate of the $^{12}C(\alpha, \gamma)^{16}O$ Reaction in Helium Burning, L43.
Auman, J. R. *See* Hutchings, Auman, Gower, and Walker.

Bahcall, John N., and Frautschi, Steven. The Hadron Barrier in Cosmology and Gravitational Collapse, L81.
Becklin, E. E., Frogel, J. A., Kleinmann, D. E., Neugebauer, G., Ney, E. P., and Strecker, D. W. Infrared Observations of the Core of Centaurus A, NGC 5128, L15.
Bradt, Hale V. *See* Kunkel and Bradt.
Bunner, A. N. *See* Coleman, Bunner, Kraushaar, and McCammon.
Burbidge, E. M., and Strittmatter, P. A. G61−29, A Helium Emission-Line Star, L39.

Coleman, P. L., Bunner, A. N., Kraushaar, W. L., and McCammon, D. X-Ray Observation of a New Soft Source in Cygnus, L47.
Counts of Radio Sources at 6-Centimeter Wavelength (Kellermann, Davis, and Pauliny-Toth), L1.

Davis, M. M. *See* Kellermann, Davis, and Pauliny-Toth.
Dupree, A. K. Radiofrequency Recombination Lines as Diagnostics of the Cool Interstellar Medium, L119.

Emery, Roger J. *See* Hoffmann, Frederick, and Emery.

Faulkner, John. Ultrashort-Period Binaries, Gravitational Radiation, and Mass Transfer. I. The Standard Model, with Applications to WZ Sagittae and Z Camelopardalis, L99.
Feldman, P. A. *See* Hughes, Feldman, and Woodsworth.
Forrest, W. J., Gillett, F. C., and Stein, W. A. Variability of Radiation from Circumstellar Grains Surrounding R Coronae Borealis, L29.
Frautschi, Steven. *See* Bahcall and Frautschi.
Frederick, Carl L. *See* Hoffmann, Frederick, and Emery.
Frogel, J. A. *See* Becklin, Frogel, Kleinmann, Neugebauer, Ney, and Strecker.
Further Observations of the Pulsating X-Ray Source Cygnus X-1 from *Uhuru* (Schreier, Gursky, Kellogg, Tananbaum, and Giacconi), L21.

G61−29, A Helium Emission-Line Star (Burbidge and Strittmatter), L39.
Giacconi, R. *See* Leong, Kellogg, Gursky, Tananbaum, and Giacconi.
Giacconi, R. *See* Schreier, Gursky, Kellogg, Tananbaum, and Giacconi.
Gillett, F. C. *See* Forrest, Gillett, and Stein.
Gower, A. C. *See* Hutchings, Auman, Gower, and Walker.
Gursky, H. *See* Leong, Kellogg, Gursky, Tananbaum, and Giacconi.
Gursky, H. *See* Schreier, Gursky, Kellogg, Tananbaum, and Giacconi.

XUM

Hadron Barrier in Cosmology and Gravitational Collapse (Bahcall and Frautschi), L81.
Hartwick, F. D. A. Abundance Ratios from the Absorption Spectrum of the Quasar PKS 0237−23, L127.
HCN in IRC+10216 (Morris, Zuckerman, Palmer, and Turner), L109.
Hjellming, R. M. *See* Wade, Hjellming, Kellermann, and Wardle.
Hobbs, L. M. Observations of Interstellar Ca I Lines, L85.
Hoffmann, William F., Frederick, Carl L., and Emery, Roger J. 100-Micron Survey of the Galactic Plane, L89.
Hughes, V. A., Feldman, P. A., and Woodsworth, A. Radio Observations of Magnetic White Dwarfs, L125.
Hutchings, J. B., Auman, J. R., Gower, A. C., and Walker, G. A. H. Ultrarapid Activity at Hα in the Spectra of Be Stars, L73.
Hyland, A. R. *See* Penston, Allen, and Hyland.

Identification of the Nucleus of NGC 5128 (Kunkel and Bradt), L7.
Infrared Observations of the Core of Centaurus A, NGC 5128 (Becklin, Frogel, Kleinmann, Neugebauer, Ney, and Strecker), L15.

Kalaghan, P. M., and Telford, L. E. Radio Observations of Mars at 8.57 Millimeters, L77.
Kellermann, K. I. *See* Wade, Hjellming, Kellermann, and Wardle.
Kellermann, K. I., Davis, M. M., and Pauliny-Toth, I. I. K. Counts of Radio Sources at 6-Centimeter Wavelength, L1.
Kellogg, E. *See* Leong, Kellogg, Gursky, Tananbaum, and Giacconi.
Kellogg, E. *See* Schreier, Gursky, Kellogg, Tananbaum, and Giacconi.
Kleinmann, D. E. *See* Becklin, Frogel, Kleinmann, Neugebauer, Ney, and Strecker.
Kraushaar, W. L. *See* Coleman, Bunner, Kraushaar, and McCammon.
Kunkel, William E., and Bradt, Hale V. Identification of the Nucleus of NGC 5128, L7.
Kuvshinov, V. M. *See* Nikulin, Kuvshinov, and Severny.

Leong, C., Kellogg, E., Gursky, H., Tananbaum, H., and Giacconi, R. X-Ray Emission from the Magellanic Clouds Observed by *Uhuru*, L67.
Long Wave Trains of Gravitational Waves from a Vibrating Black Hole (Press), L105.

McCammon, D. *See* Coleman, Bunner, Kraushaar, and McCammon.
Manual of Style for the Astrophysical Journal, L51.
Mather, John C., Werner, Michael W., and Richards, P. L. A Search for Spectral Features in the Submillimeter Background Radiation, L59.
Morris, M., Zuckerman, B., Palmer, Patrick, and Turner, B. E. HCN in IRC+10216, L109.

Nature of Becklin's Star (Penston, Allen, and Hyland), L33.
Neugebauer, G. *See* Becklin, Frogel, Kleinmann, Neugebauer, Ney, and Strecker.
New Galactic H_2O Sources Associated with H II Regions (Turner and Rubin), L113.
Ney, E. P. *See* Becklin, Frogel, Kleinmann, Neugebauer, Ney, and Strecker.
Nikulin, N. S., Kuvshinov, V. M., and Severny, A. B. On the Circular Polarization of Some Peculiar Objects, L53.

Observations of Interstellar Ca I Lines (Hobbs), L85.
100-Micron Survey of the Galactic Plane (Hoffmann, Frederick, and Emery), L89.
On the Circular Polarization of Some Peculiar Objects (Nikulin, Kuvshinov, and Severny), L53.

Palmer, Patrick. *See* Morris, Zuckerman, Palmer, and Turner.
Pauliny-Toth, I. I. K. *See* Kellermann, Davis, and Pauliny-Toth.

Penston, M. V., Allen, D. A., and Hyland, A. R. The Nature of Becklin's Star, L33.
Prediction of the Rate of the $^{12}C(\alpha, \gamma)^{16}O$ Reaction in Helium Burning (Arnett), L43.
Press, William H. Long Wave Trains of Gravitational Waves from a Vibrating Black Hole, L105.

Radio Emission from the Nucleus of NGC 5128 (Wade, Hjellming, Kellermann, and Wardle), L11.
Radiofrequency Recombination Lines as Diagnostics of the Cool Interstellar Medium (Dupree), L119.
Radio Observations of Magnetic White Dwarfs (Hughes, Feldman, and Woodsworth), L125.
Radio Observations of Mars at 8.57 Millimeters (Kalaghan and Telford), L77.
Richards, P. L. *See* Mather, Werner, and Richards.
Rubin, R. H. *See* Turner and Rubin.

Schreier, E., Gursky, H., Kellogg, E., Tananbaum, H., and Giacconi, R. Further Observations of the Pulsating X-Ray Source Cygnus X-1 from *Uhuru*, L21.
Search for Spectral Features in the Submillimeter Background Radiation (Mather, Werner, and Richards), L59.
Severny, A. B. *See* Nikulin, Kuvshinov, and Severny.
Stein, W. A. *See* Forrest, Gillett, and Stein.
Strecker, D. W. *See* Becklin, Frogel, Kleinmann, Neugebauer, Ney, and Strecker.
Strittmatter, P. A. *See* Burbidge and Strittmatter.

Tananbaum, H. *See* Leong, Kellogg, Gursky, Tananbaum, and Giacconi.
Tananbaum, H. *See* Schreier, Gursky, Kellogg, Tananbaum, and Giacconi.
Telford, L. E. *See* Kalaghan and Telford.
Turner, B. E. *See* Morris, Zuckerman, Palmer, and Turner.
Turner, B. E., and Rubin, R. H. New Galactic H_2O Sources Associated with H II Regions, L113.

Ultrarapid Activity at Hα in the Spectra of Be Stars (Hutchings, Auman, Gower, and Walker), L73.
Ultrashort-Period Binaries, Gravitational Radiation, and Mass Transfer. I. The Standard Model, with Applications to WZ Sagittae and Z Camelopardalis (Faulkner), L99.

Variability of Radiation from Circumstellar Grains Surrounding R Coronae Borealis (Forrest, Gillett, and Stein), L29.

Wade, C. M., Hjellming, R. M., Kellermann, K. I., and Wardle, J. F. C. Radio Emission from the Nucleus of NGC 5128, L11.
Walker, G. A. H. *See* Hutchings, Auman, Gower, and Walker.
Wardle, J. F. C. *See* Wade, Hjellming, Kellermann, and Wardle.
Werner, Michael W. *See* Mather, Werner, and Richards.
Woodsworth, A. *See* Hughes, Feldman, and Woodsworth.

X-Ray Emission from the Magellanic Clouds Observed by *Uhuru* (Leong, Kellogg, Gursky, Tananbaum, and Giacconi), L67.
X-Ray Observation of a New Soft Source in Cygnus (Coleman, Bunner, Kraushaar, and McCammon), L47.

Zuckerman, B. *See* Morris, Zuckerman, Palmer, and Turner.

XUM

VOLUME 170 NUMBER 3, PART 3

THE ASTROPHYSICAL JOURNAL

1971 DECEMBER 15

ANNUAL INDEX OF AUTHORS

TO VOLUMES 163–170 PARTS 1 AND 2
AND
TO THE SUPPLEMENT SERIES
VOLUME 22, PAGES 319–484,
AND VOLUME 23

THE UNIVERSITY OF CHICAGO PRESS
CHICAGO, ILLINOIS, U.S.A.

ASJOAB 170 (3, Pt. 3) 1–52 (1971)

XUM

THE UNIVERSITY OF CHICAGO PRESS, CHICAGO 60637
© 1971 by The University of Chicago. All rights reserved.
Printed in U.S.A.

1971 ANNUAL INDEX OF AUTHORS

Abhyankar, K. D., and Fymat, A. L. Tables of Auxiliary Functions for the Non-conservative Rayleigh Phase Matrix in Semi-infinite Atmospheres, **165**, 673; Suppl., **23**, 35 (No. 195).

Abraham, Zulema, and Iben, Icko, Jr. More Solar Models and Neutrino Fluxes, **170**, 157.

Abt, Helmut A., and Hudson, Katherine I. Rotational Velocities in Short-Period A-Type Binaries, **163**, 333.

Adams, Charles N. See Kattawar and Adams, Flux and Polarization Reflected from a Rayleigh-scattering Planetary Atmosphere, **167**, 183.

———. See Kattawar et al., Flux and Polarization Calculations of the Radiation Reflected from the Clouds of Venus, **170**, 371.

Adams, Thomas F. The Effect of Recoil in Resonance-Line Scattering, **168**, 575.

Aizenman, Morris L. See Demarque et al., The Early Evolution of Population II Stars. II, **163**, 37.

Albada, T. S. van, and Baker, Norman. On the Masses, Luminosities, and Compositions of Horizontal-Branch Stars, **169**, 311.

Alexander, Joseph K., Brandt, John C., Maran, Stephen P., and Stecher, Theodore P. The Gum Nebula: Further Evidence from Spacecraft and Ground-based Instruments, **167**, 487.

Allen, D. A. See Penston et al., The Nature of Becklin's Star, **170**, L33.

———. See Swings and Allen, The Infrared Object HD 45677, **167**, L41.

Aller, Lawrence H. See Smith and Aller, A Detailed Comparison of the Spectra of a Planetary Nucleus and a Wolf-Rayet Star, **164**, 275.

Aller, L. H. See Czyzak et al., Spectrophotometric Studies of Gaseous Nebulae. XIX. The Moderate-Excitation Planetary NGC 6826, **168**, 405.

———. See Kaler et al., The Continuous Spectrum of Neutral Helium from Gaseous Nebulae, **163**, 141.

———. See Kaler et al., Line Intensities in NGC 7027, **169**, 199.

Alschuler, William R. See Conti and Alschuler, Spectroscopic Studies of O-Type Stars. I. Classification and Absolute Magnitudes, **170**, 325.

Anderson, Kurt S. On the Interpretation of the Hα Profile of the Seyfert Galaxy NGC 5548, **169**, 449.

Anderson, Kurt S., and Kraft, Robert P. Abundance Analyses of Population II Variable Stars. II. TW Capricorni, **167**, 119.

———. Further Spectroscopic Observations of the Nucleus of the Seyfert Galaxy NGC 4151, **165**, L3.

Andrew, Bryan H. See Wills et al., Ohio Radio-Source Spectra: List II, **169**, L87.

Andrews, M. H., Hjellming, R. M., and Churchwell, E. Non-LTE Analysis of Data on Radio Recombination Lines for Five H II Regions, **167**, 245.

Angel, J. R. P. See Kestenbaum et al.,

XUM

Correlated Transient Short-Period Oscillation in the Optical and X-Ray Flux from Scorpius X-1, **169**, L49.

Angel, J. R. P. See Kestenbaum et al., X-Ray Spectrum of Scorpius X-1 Obtained with a Bragg Crystal Spectrometer, **164**, L87.

———. See Landstreet and Angel, Discovery of Circular Polarization in the White Dwarf G99–37, **165**, L67.

Angel, J. R. P., Kestenbaum, H., and Novick, R. Evidence of High-Frequency Oscillations in the X-Ray Flux from Scorpius X-1, **169**, L57.

Angel, J. R. P., and Landstreet, J. D. Detection of Circular Polarization in a Second White Dwarf, **164**, L15.

———. Discovery of Periodic Variations in the Circular Polarization of the White Dwarf G195–19, **165**, L71.

Arnett, W. David. An Analytic Approach to the Evolution of Degenerate Carbon Cores of Stars, **169**, 113.

———. Galactic Evolution and Nucleosynthesis, **166**, 153.

———. A Prediction of the Rate of the $^{12}C(\alpha, \gamma)^{16}O$ Reaction in Helium Burning, **170**, L43.

———. Supernova Light Curves and Presupernova Models, **163**, 11.

———. See Howard et al., Explosive Nucleosynthesis in Helium Zones, **165**, 495.

———. See Talbot and Arnett, The Evolution of Galaxies. I. Formulation and Mathematical Behavior of the One-Zone Model, **170**, 409.

Arnett, W. David, Truran, J. W., and Woosley, Stanford E. Nucleosynthesis in Supernova Models. II. The ^{12}C Detonation Model, **165**, 87.

Arny, Thomas. Importance of the Internal Velocity Field in Star Formation, **169**, 289.

Arons, Jonathan. Radiative Transfer of Isotropic X-Rays and Gamma Rays. I. General Theory and Solutions for a Uniform Medium, **164**, 437.

———. Radiative Transfer of Isotropic X-Rays and Gamma Rays. II. High-Energy Radiation in the Expanding Universe, **164**, 457.

Arons, Jonathan, McCray, Richard, and Silk, Joseph. Interaction of Fast Particles with Intergalactic Matter, **170**, 431.

Arp, Halton, and Bertola, Francesco. Faint Outer Regions of Elliptical Galaxies, **163**, 195.

Arp, H. C., and Hartwick, F. D. A. A Photometric Study of the Metal-rich Globular Cluster M71, **167**, 499.

Athay, R. Grant, and Skumanich, A. Thermalization Lengths and Mean Numbers of Scatterings for Line Photons, **170**, 605.

Auchmuty, J. F. G., and Beals, Richard. Models of Rotating Stars, **165**, L79.

Auman, J. R. See Hutchings et al., Ultrarapid Activity at Hα in the Spectra of Be Stars, **170**, L73.

Austin, Sam M., Trentelman, G. F., and Kashy, E. Energy of the Second Excited State of ^{12}C and the Rate of the Triple-Alpha Reaction, **163**, L79.

Axel, Leon, and Perkins, Francis. Mass Accretion and Pulsational Stability, **163**, 29.

Axford, W. I. See Johnson and Axford, Galactic Winds, **165**, 381.

Bahcall, John N., Bahcall, Neta A., and Burbidge, G. R. Relative Correlation of Large- and Small-Redshift Quasi-stellar Objects with Clusters of Galaxies, **166**, L77.

Bahcall, John N., Callan, C. G., Jr., and Dashen, Roger. Quark Fusion in Quasi-stellar Objects?, **163**, 239.

Bahcall, John N., and Frautschi, Steven. The Hadron Barrier in Cosmology and Gravitational Collapse, **170**, L81.

Bahcall, John N., and Goldsmith, Samuel. On the Absorption-Line Spectrum of 4C 05.34, **170**, 17.

Bahcall, John N., and Oke, J. B. Some Inferences from Spectrophotometry of Quasi-stellar Sources, **163**, 235.

Bahcall, John N., and Ulrich, Roger K. Solar Neutrinos. III. Composition and Magnetic-Field Effects and Related Inferences, **170**, 593.

Bahcall, Neta A. See Bahcall et al., Relative Correlation of Large- and Small-Red-

shift Quasi-stellar Objects with Clusters of Galaxies, **166**, L77.
Bahng, J. D. R. Rapid Variations in the Spectrum of Zeta Tauri, **167**, L75.
Baird, K. M., and Bredohl, H. A Laboratory Determination of the Frequency of the 10-Centimeter Radio Line of CH by Optical Measurements, **169**, L83.
Baity, W. H., Teegarden, B., Lezniak, J. A., and Webber, W. R. Intensities of Low-Energy Cosmic-Ray ^{2}H and ^{3}He Nuclei Measured in 1967-1968, **164**, 521.
Baker, James C. See Mathews and Baker, Galactic Winds, **170**, 241.
Baker, Norman. See Albada and Baker, On the Masses, Luminosities, and Compositions of Horizontal-Branch Stars, **169**, 311.
Balamore, Dilip S. See Sanders and Balamore, Dust Scattering in the Filaments of M82, **166**, 7.
Ball, J. A., Gottlieb, C. A., and Radford, H. E. Search for Extraterrestrial $H_2{}^{18}O$ Emission, **163**, 429.
Ball, John A. See Chaisson and Ball, Radiofrequency Detection of an Anomalous Interstellar Recombination Line, **169**, 495.
———. See Zuckerman et al., Microwave Detection of Interstellar Formic Acid, **163**, L41.
Ball, John A., Gottlieb, Carl A., Meeks, M. L., and Radford, H. E. Search for the $^{2}\Pi_{1/2}$, J = 5/2 Excited State of OH in W3, **163**, L33.
Bame, S. J. See Burlaga et al., Energy Transfer at Colliding Streams in the Solar Wind, **164**, 137.
Bardeen, James M. A Reexamination of the Post-Newtonian Maclaurin Spheroids, **167**, 425.
Bardeen, James M., and Wagoner, Robert V. Relativistic Disks. I. Uniform Rotation, **167**, 359.
Barkat, Z. On the Evolution of Growing Stellar Cores and Presupernova Models, **163**, 433.
Barkat, Zalman. See Buchler et al., Thermonuclear Detonations in Evolved Stellar Cores, **167**, 465.
Barker, Timothy, Baumgart, Leona D., Butler, Dennis, Cudworth, Kyle M., Kemper, Edward, Kraft, Robert P., Lorre, Jean, Rao, N. Kameswara, Reagan, Glenn H., and Soderblom, David R. Abundance Analyses of Population II Variable Stars. I. W Virginis, **165**, 67.
Barnes, Aaron, Hartle, R. E., and Bredekamp, J. H. On the Energy Transport in Stellar Winds, **166**, L53.
Barnes, C. A. See Toevs et al., Stellar Rates for the $^{28}Si(\alpha,\gamma)^{32}S$ and $^{16}O(\alpha,\gamma)^{20}Ne$ Reactions, **169**, 421.
Barnes, J. V. See Hill et al., A Spectroscopic Study of Algol, **168**, 443.
Barrett, A. H., Schwartz, P. R., and Waters, J. W. Detection of Methyl Alcohol in Orion at a Wavelength of ~1 Centimeter, **168**, L101.
Barrett, J. W. See Usher et al., I Zw 1: A Variable Compact Galaxy, **165**, 647.
Barry, J. R. See Rottman et al., Lyman-Alpha Emission from Arcturus, **165**, 661.
Batchelor, R. See Kellermann et al., High-Resolution Observations of Compact Radio Sources at 6 and 18 Centimeters, **169**, 1.
Baumgart, Leona D. See Barker et al., Abundance Analyses of Population II Variable Stars. I. W Virginis, **165**, 67.
Baym, Gordon, Pethick, Christopher, and Sutherland, Peter. The Ground State of Matter at High Densities: Equation of State and Stellar Models, **170**, 299.
Beals, Richard. See Auchmuty and Beals, Models of Rotating Stars, **165**, L79.
Becker, D. G. See Friichtenicht and Becker, Measurements of the Ionization Probability of Cu and LaB_6 Simulated Micrometeors, **166**, 717.
Becker, D. G., and Friichtenicht, J. F. Measurement and Interpretation of the Luminous Efficiencies of Fe and Cu Simulated Micrometeors, **166**, 699.
Becklin, E. E., Frogel, J. A., Kleinmann, D. E., Neugebauer, G., Ney, E. P., and Strecker, D. W. Infrared Observations of the Core of Centaurus A, NGC 5128, **170**, L15.
Beer, Reinhard, Norton, Robert H., and

XUM

Martonchik, John V. Absorption by Venus in the 3-4-Micron Region, **168**, L121.

Beery, J. G. See Morrison et al., Thermal Inertia of Ganymede from 20-Micron Eclipse Radiometry, **167**, L107.

Belcher, J. W. Alfvénic Wave Pressures and the Solar Wind, **168**, 509.

Belton, M. J. S., McElroy, M. B., and Price, M. J. The Atmosphere of Uranus, **164**, 191.

Bendt, Janet E., and Davis, Cecil G., Jr. A Radiative-Transfer Model of a Cepheid, **169**, 333.

Benson, R. C. See Rubin et al., Microwave Detection of Interstellar Formamide, **169**, L39.

Bergh, Sidney van den. Expansion of the Optical Remnant of B Cassiopeiae = 3C 10, **168**, 37.

———. Optical Studies of Cassiopeia A. II. *UBV* Photometry of Field Stars, **165**, 259 (Erratum, **167**, 559).

———. Optical Studies of Cassiopeia A. III. Spectra of the Supernova Remnant, **165**, 457.

———. See Peimbert and van den Bergh, Optical Studies of Cassiopeia A. IV. Physical Conditions in the Gaseous Remnant, **167**, 223.

Berry, H. G. See Smith et al., Lifetime Measurements and Absolute Oscillator Strengths for Some Vacuum-Ultraviolet Transitions in O I and O II, **165**, 217.

Berthel, R. O. See Wolnik et al., Measurements of Oscillator Strengths for Fe I and Fe II, **166**, L31.

Bertola, Francesco. See Arp and Bertola, Faint Outer Regions of Elliptical Galaxies, **163**, 195.

Bidelman, William P. V605 Aquilae: An Extragalactic Supernova?, **165**, L7.

Billings, Dana F. See Trehan and Billings, On the Oscillations of a Magnetic Polytrope, **169**, 567.

Blake, Richard L., and House, Lewis L. Solar Suprathermal Event Deduced from X-Ray Lines, **166**, 423.

Bleach, R. B. See Holt et al., Evidence for Multiple Periodicity in the X-Ray Emission from Cygnus X-1, **166**, L65.

Bodenheimer, Peter. Rapidly Rotating Stars. VII. Effects of Angular Momentum on Upper-Main-Sequence Models, **167**, 153.

Boesgaard, Ann Merchant. The Lithium Content of Capella, **167**, 511.

Boeshaar, Patricia C., and Kraus, John D. Ohio Radio Sources in Clusters of Galaxies, **165**, 445.

Boitnott, Charles A. See Savage and Boitnott, Light Emission Measurements of Calcium and Magnesium at Simulated Meteor Conditions. I. Cross-Section Measurements, **167**, 341.

Boitnott, Charles A., and Savage, Howard F. Light Emission Measurements of Calcium and Magnesium at Simulated Meteor Conditions. II. Spectral Luminous Efficiencies, **167**, 349.

Boldt, E. A. See Holt et al., Evidence for Multiple Periodicity in the X-Ray Emission from Cygnus X-1, **166**, L65.

———. See Ramaty et al., Ionization and Heating of the Gum Nebula by Energetic Particles from the Vela X Supernova, **169**, 87.

Boldt, E. A., Desai, U. D., Holt, S. S., and Serlemitsos, P. J. A Limit on Line Emission in the X-Ray Background at High Galactic Latitudes, **167**, L1.

Boldt, E. A., Holt, S. S., and Serlemitsos, P. J. Search for Temporal Structure in X-Rays from Scorpius X-1, **164**, L9.

Bond, G. R., and Siewert, C. E. On the Nonconservative Equation of Transfer for a Combination of Rayleigh and Isotropic Scattering, **164**, 97.

Bond, Howard E. The Optically Variable Radio Source PKS 1514−24 = AP Librae, **167**, L79.

Bond, Howard E., and MacConnell, Darrell J. The Nature of the Field Blue-Straggler Stars, **165**, 51.

Bonner, T. I. See Davids and Bonner, Enhancement of the $3\,^4\mathrm{He} \rightarrow {}^{12}\mathrm{C}$ Reaction Rate by Inelastic Proton Scattering, **166**, 405.

Bopp, B. W. See Moffett and Bopp, Discovery of Flare Activity on YY Geminorum, **168**, L117.

Boughn, S. P., Fram, D. M., and Partridge,

R. B. Isotropy of the Microwave Background at 8-Millimeter Wavelength, **165**, 439.
Bowyer, Stuart. See Lampton et al., Simultaneous Radio and Optical Measurements of Scorpius XR-1, **164**, L61.
———. See Lampton et al., X-Ray Observations of Virgo XR-1, **168**, L1.
———. See Margon et al., Evidence for a Highly Compact X-Ray Source, **169**, L45.
———. See Margon et al., A Pulsing X-Ray Source in Circinus, **169**, L23.
Boynton, Paul E. See Horowitz et al., Optical Time-of-Arrival Measurements from the Crab Pulsar: Comparison of Results from Four Observatories, **166**, L91.
Bradt, Hale V. See Kunkel and Bradt, Identification of the Nucleus of NGC 5128, **170**, L7.
Branch, David, and Greenstein, Jesse L. The 1961 Supernova in NGC 1058, **167**, 89.
Brandt, John C. See Alexander et al., The Gum Nebula: Further Evidence from Spacecraft and Ground-based Instruments, **167**, 487.
———. See Wolff et al., A Two-Component Model of the Quiet Solar Wind with Viscosity, Magnetic Field, and Reduced Heat Conduction, **165**, 181.
Brandt, John C., Stecher, Theodore P., Crawford, David L., and Maran, Stephen P. The Gum Nebula: Fossil Strömgren Sphere of the Vela X Supernova, **163**, L99.
Bredekamp, J. H. See Barnes et al., On the Energy Transport in Stellar Winds, **166**, L53.
Bredohl, H. See Baird and Bredohl, A Laboratory Determination of the Frequency of the 10-Centimeter Radio Line of CH by Optical Measurements, **169**, L83.
Broderick, J. See Kellermann et al., High-Resolution Observations of Compact Radio Sources at 6 and 18 Centimeters, **169**, 1.
Broderick, J. J. See Cohen et al., The Small-Scale Structure of Radio Galaxies and Quasi-stellar Sources at 3.8 Centimeters, **170**, 207.
Brolley, John E. Analogue of the Primary Solar Reaction, **169**, 443.
Bromander, J. See Smith et al., Lifetime Measurements and Absolute Oscillator Strengths for Some Vacuum-Ultraviolet Transitions in O I and O II, **165**, 217.
Brooks, J. W. See Goss et al., The Parkes Survey of 21-Centimeter Absorption in Discrete-Source Spectra. IV. 21-Centimeter Absorption Measurements on Low-Latitude Sources South of Declination -46°, **170**, 617.
———. See Radhakrishnan et al., The Parkes Survey of 21-Centimeter Absorption in Discrete-Source Spectra. I. The Parkes Hydrogen-Line Interferometer, **170**, 617.
———. See Radhakrishnan et al., The Parkes Survey of 21-Centimeter Absorption in Discrete-Source Spectra. III. 21-Centimeter Absorption Measurements on 41 Galactic Sources North of Declination -48°, **170**, 617.
Brown, Robert L. On the Photoionization of Hydrogen and Helium, **164**, 387.
———. See Silk and Brown, On the Ultraviolet Absorption-Line Spectra Produced by H I Regions, **163**, 495.
Brown, Robert T. Photoionization Cross-Sections for Helium-like Positive Ions, **170**, 387.
Brucato, R. See Kristian et al., On the Optical Identification of Cygnus X-1, **168**, L91.
Brueckner, Keith A. Collision Broadening by Neutral Hydrogen, **169**, 621.
Bruenn, Stephen W. The Effect of Beta Processes on the Dynamic Evolution of Carbon-Detonation Supernovae, **168**, 203.
Buchler, Jean-Robert, Wheeler, J. Craig, and Barkat, Zalman. Thermonuclear Detonations in Evolved Stellar Cores, **167**, 465.
Buchta, R. See Smith et al., Lifetime Measurements and Absolute Oscillator Strengths for Some Vacuum-Ultraviolet Transitions in O I and O II, **165**, 217.

XUM

Buhl, David. See Snyder and Buhl, Observations of Radio Emission from Interstellar Hydrogen Cyanide, **163**, L47.

Bunner, A. N. See Coleman et al., X-Ray Observation of a New Soft Source in Cygnus, **170**, L47.

———. See McCammon et al., A Search for Absorption of the Soft X-Ray Diffuse Flux by the Small Magellanic Cloud, **168**, L33.

Bunner, A. N., Coleman, P. L., Kraushaar, W. L., and McCammon, D. Low-Energy Diffuse X-Rays, **167**, L3.

Burbidge, E. M., and Burbidge, G. R. 3C 390.3, an N System with Two Emission Redshifts, **163**, L21.

Burbidge, E. M., Burbidge, G. R., Solomon, P. M., and Strittmatter, P. A. Apparent Associations between Bright Galaxies and Quasi-stellar Objects, **170**, 233.

Burbidge, E. M., and Strittmatter, P. A. G61–29, A Helium Emission-Line Star, **170**, L39.

Burbidge, E. Margaret. See Chan and Burbidge, Properties of Gas That Produces Absorption Lines in Some Quasi-stellar Objects. **167**, 213.

Burbidge, E. Margaret, and Hodge, Philip M. Is NGC 4569 a Member of the Virgo Cluster?, **166**, 1.

Burbidge, G. R. See Bahcall et al., Relative Correlation of Large- and Small-Redshift Quasi-stellar Objects with Clusters of Galaxies, **166**, L77.

———. See Burbidge and Burbidge, 3C 390.3, an N System with Two Emission Redshifts, **163**, L21.

———. See Burbidge et al., Apparent Associations between Bright Galaxies and Quasi-stellar Objects, **170**, 233.

Burger, J. J. A Phenomenological Approach to the Solar Modulation of Cosmic Rays, **166**, 651.

Burginyon, G. See Palmieri et al., Soft X-Rays from Two Supernova Remnants, **164**, 61.

Burginyon, G. A. See Palmieri et al., Diffuse Cosmic X-Ray Flux from 0.2 to 2 keV, **169**, 33.

———. See Seward et al., X-Rays from Puppis A and the Vicinity of Vela X, **169**, 515.

Burke, B. F. See Johnston et al., An Interferometer Map of the Water-Vapor Sources in W49, **166**, L21.

Burlaga, L. F., Ogilvie, K. W., Fairfield, D. H., Montgomery, M. D., and Bame, S. J. Energy Transfer at Colliding Streams in the Solar Wind, **164**, 137.

Burns, W. Robert, and Roberts, Morton S. The Neutral-Hydrogen Distribution and Rotation Parameters of the Spiral Galaxy NGC 2403, **166**, 265.

Buselli, G. See Davison et al., Weak X-Ray Sources in the Southern Hemisphere, **167**, 479.

Butler, Dennis. See Barker et al., Abundance Analyses of Population II Variable Stars. I. W Virginis, **165**, 67.

Butterworth, E. Manning, and Miller, Richard H. Relaxation Time in Clusters with Pair Correlations, **170**, 275.

Byrd, Gene G. See Wagner et al., Spectrophotometry of Nova Serpentis 1970, **165**, 431.

Cahn, J. H., and Kaler, J. B. The Distances and Distribution of Planetary Nebulae, **163**, 207; Suppl., **22**, 319 (No. 189).

Caldwell, James. The *X*- and *Y*-Functions of Chandrasekhar, **163**, 111.

Callan, C. G., Jr. See Bahcall et al., Quark Fusion in Quasi-stellar Objects?, **163**, 239.

Cameron, A. G. W., and Fowler, W. A. Lithium and the *s*-Process in Red-Giant Stars, **164**, 111.

Cannon, C. J., and Rees, D. E. Line Transfer in the Presence of Two-dimensional Velocity Gradients, **169**, 157.

Cannon, W. See Cohen et al., The Small-Scale Structure of Radio Galaxies and Quasi-stellar Sources at 3.8 Centimeters, **170**, 207.

Canuto, V. See Chiu and Canuto, Theory of Radiation Mechanisms of Pulsars. I, **163**, 577.

Capps, Richard W. See Young and Capps, Hyades Membership of the White-Dwarf Eclipsing System BD+16°516, **166**, L81.

Capriotti, Eugene. The Formation of

Condensations in Planetary Nebulae. I, **166**, 563.
Carbon, Duane F. See Chaffee et al., Abundances in Open Clusters: Model-Atmosphere Abundance Analysis of Stars in the Pleiades and Hyades Clusters, **166**, 593.
Carleton, Nathaniel. See Horowitz et al., Optical Time-of-Arrival Measurements from the Crab Pulsar: Comparison of Results from Four Observatories, **166**, L91.
Carleton, N. P. See Horowitz et al., Results of a Search for Optical Pulsars, **163**, L5.
Carmichael, Hugh. See Stoker and Carmichael, Steplike Changes in the Long-Term Modulation of Cosmic Rays, **169**, 357.
Carruthers, George R. Far-Ultraviolet Spectra and Photometry of Perseus Stars, **166**, 349.
———. See Weber et al., Far-Ultraviolet Interstellar Absorption in Orion and Monoceros, **166**, 543.
Cartwright, Brian G. The Origin of Fluorine, Sodium, and Aluminum in the Galactic Cosmic Radiation, **169**, 299.
Cassinelli, Joseph P. Extended Model Atmospheres for the Central Stars of Planetary Nebulae, **165**, 265.
Castor, John I. On the Calculation of Linear, Nonadiabatic Pulsations of Stellar Models, **166**, 109.
Cavaliere, A., Morrison, P., and Wood, K. On Quasar Evolution, **170**, 223.
Cesarsky, Catherine J., and Cesarsky, Diego A. Interpretation of Recombination-Line Emission from the Interstellar Medium, **169**, 293.
Cesarsky, Diego A. Detection of H137α Recombination-Line Emission from an H I Region in the Direction of NGC 2024, **167**, L89.
———. See Cesarsky and Cesarsky, Interpretation of Recombination-Line Emission from the Interstellar Medium, **169**, 293.
Chaffee, Frederic. See Schild and Chaffee, Energy Distributions and Spectra of Orion B Stars, **169**, 529.
Chaffee, Frederic H., Jr., Carbon, Duane F., and Strom, Stephen E. Abundances in Open Clusters: Model-Atmosphere Abundance Analysis of Stars in the Pleiades and Hyades Clusters, **166**, 593.
Chaisson, Eric J. Detection of an Unidentified Emission Feature in the Microwave Spectrum of W3, **167**, L61.
———. High-Frequency Confirmation of a Radio Recombination Line from an H I Region, **170**, 81.
———. See Dickinson and Chaisson, Search for Extragalactic H_2O, **169**, 207.
Chaisson, Eric J., and Ball, John A. Radiofrequency Detection of an Anomalous Interstellar Recombination Line, **169**, 495.
Chambliss, Carlson R. Photoelectric Photometry of the Dwarf Cepheid HD 199757, **165**, 365.
Chan, Y. W. Tung, and Burbidge, E. Margaret. Properties of Gas That Produces Absorption Lines in Some Quasi-stellar Objects, **167**, 213.
Chandrasekhar, S. An Announcement for Our Authors, **164**, 397; **164**, L79.
———. The Post-Newtonian Effects of General Relativity on the Equilibrium of Uniformly Rotating Bodies. V. The Deformed Figures of the Maclaurin Spheroids (*Continued*), **167**, 447.
———. The Post-Newtonian Effects of General Relativity on the Equilibrium of Uniformly Rotating Bodies. VI. The Deformed Figures of the Jacobi Ellipsoids (*Continued*), **167**, 455.
Chapman, Robert D., and Henry, Ronald J. W. Photoionization Cross-Sections for Atoms and Ions of Sulfur, **168**, 169.
Chau, W. Y., Henriksen, R. N., and Rayburn, D. R. Evolution of a Stabilized Oblique Rotator: Behavior over Short and Long Time Scales, **168**, L79.
Cheung, A. C. See Knowles and Cheung, Further Investigations of NH_3 Inversion Radiation, **164**, L19.
Chin, Chao-wen, and Stothers, Richard. Low-Mass White Dwarfs and the Cooling Sequences in the Hyades Clusters, **163**, 555.
Chincarini, Guido, and Rood, Herbert J.

XUM

Dynamics of the Perseus Cluster of Galaxies, **168**, 321.
Chincarini, Guido, Rood, Herbert J., Sastry, Gummuluru N., and Welch, Gary A. A Supermassive Double Galaxy in the Cluster Abell 1775, **169**, 11.
Chiu, Hong-Yee. See Hudson et al., Automated and Conventional Photometry of the Short-Period Variable Star 14 Aurigae, **165**, 573.
Chiu, H. Y., and Canuto, V. Theory of Radiation Mechanisms of Pulsars. I, **163**, 577.
Chubb, T. A. See Doschek et al., Heliumlike Calcium Emission Observed during a Solar Flare, **164**, 165.
———. See Doschek et al., Iron-Line Emission during Solar Flares, **170**, 573.
———. See Shulman et al., Line Emission in the X-Ray Background, **166**, L9.
Chubb, Talbot. See Henry et al., Excess Background Radiation of Soft X-Rays at the Galactic Pole and Plane, **163**, L73.
Chubb, Talbot A. See Fritz et al., The X-Ray Spectra of the Crab Nebula and NP 0532, **164**, L55.
Churchwell, E. See Andrews et al., Non-LTE Analysis of Data on Radio Recombination Lines for Five H II Regions, **167**, 245.
Clancy, M. C. See Davison et al., Weak X-Ray Sources in the Southern Hemisphere, **167**, 479.
Clark, B. G. See Kellermann et al., High-Resolution Observations of Compact Radio Sources at 6 and 18 Centimeters, **169**, 1.
Clayton, Donald D. See Howard et al., Explosive Nucleosynthesis in Helium Zones, **165**, 495.
Clement, Maurice J. See Harris and Clement, Differential Rotation in Stars on the Upper Main Sequence. II, **167**, 321.
———. See Marks and Clement, On the Behavior of the Angular Velocity near the Surfaces of Stars with Radiative Envelopes, **166**, L27.
Cocke, W. J. See Kestenbaum et al., Correlated Transient Short-Period Oscillation in the Optical and X-Ray Flux from Scorpius X-1, **169**, L49.
Cocke, W. J., Muncaster, G. W., and Gehrels, T. Upper Limit to Circular Polarization of Optical Pulsar NP 0532, **169**, 119.
Cohen, Martin, and Woolf, N. J. Two Young Bright Infrared Objects, **169**, 543.
Cohen, M. H. See Kellermann et al., High-Resolution Observations of Compact Radio Sources at 6 and 18 Centimeters, **169**, 1.
Cohen, M. H., Cannon, W., Purcell, G. H., Shaffer, D. B., Broderick, J. J., Kellermann, K. I., and Jauncey, D. L. The Small-Scale Structure of Radio Galaxies and Quasi-stellar Sources at 3.8 Centimeters, **170**, 207.
Coleman, P. L. See Bunner et al., Low-Energy Diffuse X-Rays, **167**, L3.
———. See McCammon et al., A Search for Absorption of the Soft X-Ray Diffuse Flux by the Small Magellanic Cloud, **168**, L33.
Coleman, P. L., Bunner, A. N., Kraushaar, W. L., and McCammon, D. X-Ray Observation of a New Soft Source in Cygnus, **170**, L47.
Colgate, S. A. See Ramaty et al., Ionization and Heating of the Gum Nebula by Energetic Particles from the Vela X Supernova, **169**, 87.
Colgate, Stirling A. Neutron-Star Formation, Thermonuclear Supernovae, and Heavy-Element Reimplosion, **163**, 221.
Colgate, Stirling A., and Noerdlinger, Peter D. Coherent Emission from Expanding Supernova Shells, **165**, 509.
Colvin, R. S. See Hughes et al., An Absorption-Line Study of the Galactic Neutral Hydrogen at 21 Centimeters Wavelength, **168**, 579; Suppl., **23**, 323 (No. 200).
Comella, J. M. See Rankin et al., Pulsar NP 0532: Disappearance of the Precursor Pulse at 606 MHz, **163**, L95.
Connerade, J. P. Analysis of Extreme-Ultraviolet Spectra by the Method of Bacher and Goudsmit, **163**, 417.

———. A Further Note on the Wavelength Overlap of Transitions from Differing Stages of Ionization, **164**, 603.
Connerade, J. P., Garton, W. R. S., and Mansfield, M. W. D. Absorption Spectrum of Na I in the Vacuum Ultraviolet, **165**, 203.
Conti, Peter S., and Alschuler, William R. Spectroscopic Studies of O-Type Stars. I. Classification and Absolute Magnitudes, **170**, 325.
Contopoulos, G. Preference of Trailing Spiral Waves, **163**, 181.
Cooper, B. F. C. See Kellermann et al., High-Resolution Observations of Compact Radio Sources at 6 and 18 Centimeters, **169**, 1.
Coppi, B., and Treves, A. Plasma Model for Thermal X-Ray Sources, **167**, L9.
Coppi, Bruno, and Friedland, Allan B. Processes of Magnetic-Energy Conversion and Solar Flares, **169**, 379.
Couch, R. G., and Shane, K. C. The Photodisintegration Rate of ^{24}Mg, **169**, 413.
Counselman, C. C., III, and Rankin, J. M. Multipath Delay Distortion of Radio Pulses from NP 0532, **166**, 513.
Cowan, G. A., and Hantel, E. G. The Possibility of Fission Multiplication in Supernovae following the *r*-Process, **167**, 101.
Cowan, Robert D. See Widing et al., On the Classification of Some Highly Ionized Iron and Nickel Lines in the 200-400 Å Region of the Solar Spectrum, **169**, 405.
Cowley, Charles R. See Fullerton and Cowley, Calculations of van der Waals Broadening for Lines of Astrophysical Interest, **165**, 643.
Cox, Donald P., and Daltabuit, Enrique. Effects of Collisional Excitation on the Intensities of the 5876 Å and 4471 Å Lines of Neutral Helium, **167**, 257 (Erratum, **169**, 635).
———. Radiative Cooling of a Low-Density Plasma, **167**, 113.
Cox, D. P. See Robbins et al., Reduced Helium Abundances in Nebulae, **169**, L77.
Crawford, David L. See Brandt et al., The Gum Nebula: Fossil Strömgren Sphere of the Vela X Supernova, **163**, L99.
Cromwell, R. H. See Disney and Cromwell, Optical Spectra of the Nuclei of Elliptical Radio Galaxies, **164**, L35.
Cruddace, Ray. See Margon et al., Evidence for a Highly Compact X-Ray Source, **169**, L45.
———. See Margon et al., A Pulsing X-Ray Source in Circinus, **169**, L23.
Cruikshank, D. P. See Morrison et al., Thermal Inertia of Ganymede from 20-Micron Eclipse Radiometry, **167**, L107.
Cudaback, David. See Horowitz et al., Optical Time-of-Arrival Measurements from the Crab Pulsar: Comparison of Results from Four Observatories, **166**, L91.
Cudaback, D. D., Gaustad, J. E., and Knacke, R. F. Silicon Monoxide in the Infrared Spectrum of Alpha Orionis, **166**, L49.
Cudworth, Kyle M. See Barker et al., Abundance Analyses of Population II Variable Stars. I. W Virginis, **165**, 67.
Cuperman, S., and Harten, A. The Electron Temperature in the Two-Component Solar Wind, **163**, 383.
———. The Radial Electric Field in the Solar Wind, **169**, 165.
Curtis, L. J. See Smith et al., Lifetime Measurements and Absolute Oscillator Strengths for Some Vacuum-Ultraviolet Transitions in O I and O II, **165**, 217.
Czyzak, S. J. See Kaler et al., Line Intensities in NGC 7027, **169**, 199.
Czyzak, S. J., Aller, L. H., and Kaler, J. B. Spectrophotometric Studies of Gaseous Nebulae. XIX. The Moderate-Excitation Planetary NGC 6826, **168**, 405.

Dalgarno, A. See Wofsy et al., Spin-Change Scattering of C II and O I by Atomic Hydrogen, **168**, 161.
Daltabuit, E. See Robbins et al., Reduced Helium Abundances in Nebulae, **169**, L77.
Daltabuit, Enrique. See Cox and Daltabuit, Effects of Collisional Excitation on

the Intensities of the 5876 Å and 4471 Å Lines of Neutral Helium, **167**, 257.
Daltabuit, Enrique. See Cox and Daltabuit, Radiative Cooling of a Low-Density Plasma, **167**, 113.
Dashen, Roger. See Bahcall et al., Quark Fusion in Quasi-stellar Objects?, **163**, 239.
Datla, R. U. See Kunze and Datla, On the Oscillator Strengths of the $3s\ ^2S$-$4p\ ^2P$ and $3d\ ^2D$-$4p\ ^2P$ Transitions in Sodiumlike Ions, **169**, 425.
Davids, Cary N., and Bonner, T. I. Enhancement of the $3\ ^4He \rightarrow\ ^{12}C$ Reaction Rate by Inelastic Proton Scattering, **166**, 405.
Davidsen, Arthur. See Fritz et al., Discovery of an X-Ray Source in Perseus, **164**, L81.
Davidson, K., Pacini, F., and Salpeter, E. E. A Cocoon Pulsar Model for Scorpius X-1, **168**, 45.
Davies, R. D. Observations of Radio Recombination Lines with $\Delta n = 1$ to 5, **163**, 479.
Davis, Cecil G., Jr. See Bendt and Davis, A Radiative-Transfer Model of a Cepheid, **169**, 333.
Davis, D. N. The Possible Identification of Promethium in S Stars, **167**, 327.
Davis, M. M. See Kellermann et al., Counts of Radio Sources at 6-Centimeter Wavelength, **170**, L1.
Davis, Sumner P. See Phillips and Davis, A New $^1\Sigma$-$^1\Sigma$ Transition of the TiO Molecule, **167**, 209.
Davison, P. J. N., Buselli, G., Clancy, M. C., and Thomas, R. M. Weak X-Ray Sources in the Southern Hemisphere, **167**, 479.
Demarque, Pierre, and Heasley, James N., Jr. A Method for the Simultaneous Determination of Helium and Metal Abundances in Old Open Clusters, **163**, 547.
Demarque, Pierre, and Mengel, John G. Advanced Evolution of Population II Stars. I. Red Giants and the Helium Flash, **164**, 317.
———. Advanced Evolution of Population II Stars. II. The Horizontal Branch, **164**, 469.
Demarque, Pierre, Mengel, John G., and Aizenman, Morris L. The Early Evolution of Population II Stars. II, **163**, 37.
Dennis, B. R. See Frost and Dennis, Evidence from Hard X-Rays for Two-Stage Particle Acceleration in a Solar Flare, **165**, 655.
Dennis, Tom R. Thermal Stability of the Helium-burning Shell in Stars of 15 Solar Masses, **167**, 311.
Dent, William A. A Search for the Redshifted Line of Neutral Hydrogen in Selected Quasi-stellar Sources, N Galaxies, and Seyfert Galaxies, **165**, 451.
Desai, U. D. See Boldt et al., A Limit on Line Emission in the X-Ray Background at High Galactic Latitudes, **167**, L1.
Devinney, Edward J. See Wilson and Devinney, Realization of Accurate Close-Binary Light Curves: Application to MR Cygni, **166**, 605.
De Young, David S. See Saslaw and De Young, On Equipartition in Galactic Nuclei and Gravitating Systems, **170**, 423.
De Young, D. S. The Dynamics of Extended Extragalactic Radio Sources, **167**, 541.
de Zafra, Robert L. Precise Laboratory Determination of Rotational Transition Frequencies in Cyanoacetylene, **170**, 165.
Dickinson, Dale F., and Chaisson, Eric J. Search for Extragalactic H_2O, **169**, 207.
Dieter, Nannielou H. See Spinrad et al., Maffei 1: A New Massive Member of the Local Group?, **163**, L25.
Disney, M. J., and Cromwell, R. H. Optical Spectra of the Nuclei of Elliptical Radio Galaxies, **164**, L35.
Dixon, M. E. An Observational Approach to the Problem of Spiral Structure, **164**, 411.
Donn, B. See Hunter and Donn, The Effect of Methane, Ammonia, and Silicates on the 3.07-Micron Ice Absorption in Interstellar Grains, **167**, 71.
———. See Julienne et al., Formation of OH through Inverse Predissociation, **170**, 65.

Donnelly, R. F. See Kane and Donnelly, Impulsive Hard X-Ray and Ultraviolet Emission during Solar Flares, **164**, 151.

Doschek, G. A., Meekins J. F., Kreplin, R. W., Chubb, T. A., and Friedman, H. Heliumlike Calcium Emission Observed during a Solar Flare, **164**, 165.

———. Iron-Line Emission during Solar Flares, **170**, 573.

Downs, G. S., and Reichley, P. E. Observations of Interstellar Scintillations of Pulsar Signals at 2388 MHz, **163**, L11.

Doxsey, R. See Rappaport et al., GX 349+2 and GX 340+0: Locations and X-Ray Pulsation Limits, **169**, L93.

———. See Rappaport et al., On the Location of Cygnus X-1, **168**, L17.

———. See Rappaport et al., A Search for X-Ray Pulsations from Cygnus X-1, **168**, L43.

Drake, G. W. F. The n $^3P_2$-1 $^1S_0$ Magnetic-Quadrupole Transitions of the Helium Sequence, **163**, 439.

Dupree, A. K. Radiofrequency Recombination Lines as Diagnostics of the Cool Interstellar Medium, **170**, L119.

Dupree, A. K., and Reeves, E. M. The Extreme-Ultraviolet Spectrum of the Quiet Sun, **165**, 599.

Durney, B. Differential Rotation, Meridional Velocities, and Pole-Equator Difference in Temperature of a Rotating Convective Spherical Shell, **163**, 353.

———. A New Type of Supersonic Solution for the Inviscid Equations of the Solar Wind, **166**, 669.

Durney, B. R., and Roberts, P. H. On the Theory of Stellar Winds, **170**, 319.

Duthie, J. G., and Murdin, Paul. Accurate Timing of Light Flashes from the Pulsar in the Crab Nebula during the 1969-1970 Season, **163**, 1.

Duthie, J. Graeme. See Horowitz et al., Optical Time-of-Arrival Measurements from the Crab Pulsar: Comparison of Results from Four Observatories, **166**, L91.

Dworetsky, Michael M. See Montgomery et al., M17 and Taurus A: 3.4-Millimeter Contour Maps and Integrated Fluxes, **167**, 77.

Dyck, H. M., Forrest, W. J., Gillett, F. C., Stein, W. A., Gehrz, R. D., Woolf, N. J., and Shawl, S. J. Visual Intrinsic Polarization and Infrared Excess of Cool Stars, **165**, 57.

Dykla, John J. See Thorne and Dykla, Black Holes in the Dicke-Brans-Jordan Theory of Gravity, **166**, L35.

Eggen, O. J. The Intermediate-Age Cluster IC 4651, **166**, 87.

———. Luminosities, Temperatures, and Kinematics of K-Type Dwarfs, **164**, 393; Suppl., **22**, 389 (No. 191); Erratum, **23**, 369.

———. Narrow- and Broad-Band Photometry of Red Stars. V. Luminosities and Temperatures for Young Disk-Population Red Stars of High Luminosity, **163**, 313.

———. Narrow- and Broad-Band Photometry of Red Stars. VI. Luminosities and Temperatures for Old Disk-Population Red Stars of High Luminosity, **165**, 317.

Elias, Jonathan H. See McCord et al., Saturn and Its Satellites: Narrow-Band Spectrophotometry (0.3-1.1 μ), **165**, 413.

Elliot, J. L., Horowitz, P., Liller, W., Papaliolios, C., and Veverka, J. A Search for an Optical Source at the Position of Centaurus XR-3, **168**, L95.

Emery, Roger J. See Hoffmann et al., 100-Micron Map of the Galactic-Center Region, **164**, L23.

———. See Hoffmann et al., 100-Micron Survey of the Galactic Plane, **170**, L89.

Engelhardt, W., and Sommer, J. Observation of 2 ^3S-2 ^3P Transitions in the He I Isoelectronic Sequence, **167**, 201.

Epstein, Eugene E. See Montgomery et al., M17 and Taurus A: 3.4-Millimeter Contour Maps and Integrated Fluxes, **167**, 77.

Esposito, F. Paul. Absorption of Gravitational Energy by a Viscous Compressible Fluid, **165**, 165.

———. Interaction of Gravitational Radia-

XUM

tion with an Inviscid Fluid in Simple Motion, **168**, 495.

Fackerell, Edward D. Relativistic, Spherically Symmetric Star Clusters. V. A Relativistic Version of Plummer's Model, **165**, 489.

———. Solutions of Zerilli's Equation for Even-Parity Gravitational Perturbations, **166**, 197.

Fainberg, Joseph, and Stone, R. G. Hectometric Solar Noise Storms: Detection of Continuum, **164**, L123.

Fairfield, D. H. See Burlaga et al., Energy Transfer at Colliding Streams in the Solar Wind, **164**, 137.

Faulkner, John. Ultrashort-Period Binaries, Gravitational Radiation, and Mass Transfer. I. The Standard Model, with Applications to WZ Sagittae and Z Camelopardalis, **170**, L99.

Faÿ, Theodore D., Jr. Computed and Observed Cyanide-Radical Spectra of Three N Stars in the Infrared, **168**, 99.

Feldman, P. A. See Hughes et al., Radio Observations of Magnetic White Dwarfs, **170**, L125.

Fernie, J. D., and Hube, Joan O. On the Existence of Stable Stars in the Cepheid Instability Strip, **168**, 437.

Fichtel, C. E., Kniffen, D. A., and Ögelman, H. B. Results of Gamma-Ray Balloon Astronomy, **168**, 581.

Field, George B. Instability and Waves Driven by Radiation in Interstellar Space and in Cosmological Models, **165**, 29.

Field, George B., and Saslaw, William C. Groups of Galaxies: Hidden Mass or Quick Disintegration?, **170**, 199.

Field, George B., and Steigman, Gary. Charge Transfer and Ionization Equilibrium in the Interstellar Medium, **166**, 59.

Fischel, D., Nethery, C. M., and Sparks, W. M. On the Outer Layers of Model Moving Atmospheres, **163**, 649.

Fischel, D., and Sparks, W. M. Partition Functions in Ionizing Plasmas, **164**, 359.

Flygare, W. H. See Rubin et al., Microwave Detection of Interstellar Formamide, **169**, L39.

Fogarty, William G. See Montgomery et al., M17 and Taurus A: 3.4-Millimeter Contour Maps and Integrated Fluxes, **167**, 77.

Folsom, G. H., Smith, A. G., Hackney, R. L., Hackney, Karen R., and Leacock, R. J. Optical Changes in Eleven Ohio Radio Sources with Unusual Spectra, **169**, L131.

Forbes, Fred F. Infrared Polarization of Venus, **165**, L21.

———. The Infrared Polarization of Eta Carinae and VY Canis Majoris, **165**, L83.

Ford, Holland C. V605 Aquilae: A Nova-like Variable in an Old Planetary Nebula, **170**, 547.

Ford, Holland C., and Jenner, David C. Dust across Maffei 1, **165**, L1.

Ford, W. Kent, Jr. See Rubin and Ford, Radial Velocities and Line Strengths of Emission Lines across the Nuclear Disk of M31, **170**, 25.

Forrest, W. J. See Dyck et al., Visual Intrinsic Polarization and Infrared Excess of Cool Stars, **165**, 57.

Forrest, W. J., Gillett, F. C., and Stein, W. A. Variability of Radiation from Circumstellar Grains Surrounding R Coronae Borealis, **170**, L29.

Fowler, W. A. See Cameron and Fowler, Lithium and the *s*-Process in Red-Giant Stars, **164**, 111.

Fowler, William A. See Toevs et al., Stellar Rates for the $^{28}\mathrm{Si}(\alpha,\gamma)^{32}\mathrm{S}$ and $^{16}\mathrm{O}(\alpha,\gamma)^{20}\mathrm{Ne}$ Reactions, **169**, 421.

Fox, Kenneth, and Ozier, Irving. The Importance of Methane to Pressure-induced Absorption in the Atmospheres of the Outer Planets, **166**, L95.

Fram, D. M. See Boughn et al., Isotropy of the Microwave Background at 8-Millimeter Wavelength, **165**, 439.

Frautschi, Steven. See Bahcall and Frautschi, The Hadron Barrier in Cosmology and Gravitational Collapse, **170**, L81.

Frederick, Carl L. See Hoffmann et al., 100-Micron Map of the Galactic-Center Region, **164**, L23.

———. See Hoffmann et al., 100-Micron

Survey of the Galactic Plane, **170**, L89.

Friedland, Allan B. See Coppi and Friedland, Processes of Magnetic-Energy Conversion and Solar Flares, **169**, 379.

Friedman, H. See Doschek et al., Helium-like Calcium Emission Observed during a Solar Flare, **164**, 165.

———. See Doschek et al., Iron-Line Emission during Solar Flares, **170**, 573.

———. See Fritz et al., Discovery of an X-Ray Source in Perseus, **164**, L81.

———. See Fritz et al., The X-Ray Spectra of the Crab Nebula and NP 0532, **164**, L55.

———. See Henry et al., Excess Background Radiation of Soft X-Rays at the Galactic Pole and Plane, **163**, L73.

———. See Shulman et al., Line Emission in the X-Ray Background, **166**, L9.

———. See Shulman et al., X-Ray Intensity Fluctuations in Cygnus XR-1, **168**, L49.

Friichtenicht, J. F. See Becker and Friichtenicht, Measurement and Interpretation of the Luminous Efficiencies of Fe and Cu Simulated Micrometeors, **166**, 699.

Friichtenicht, J. F., and Becker, D. G. Measurements of the Ionization Probability of Cu and LaB_6 Simulated Micrometeors, **166**, 717.

Fritz, Gilbert. See Henry et al., Excess Background Radiation of Soft X-Rays at the Galactic Pole and Plane, **163**, L73.

———. See Shulman et al., Line Emission in the X-Ray Background, **166**, L9.

———. See Shulman et al., X-Ray Intensity Fluctuations in Cygnus XR-1, **168**, L49.

Fritz, Gilbert, Davidsen, Arthur, Meekins, John F., and Friedman, H. Discovery of an X-Ray Source in Perseus, **164**, L81.

Fritz, Gilbert, Meekins, John F., Chubb, Talbot A., Friedman, H., and Henry, Richard C. The X-Ray Spectra of the Crab Nebula and NP 0532, **164**, L55.

Frogel, J. A. See Becklin et al., Infrared Observations of the Core of Centaurus A, NGC 5128, **170**, L15.

Frost, K. J., and Dennis, B. R. Evidence from Hard X-Rays for Two-Stage Particle Acceleration in a Solar Flare, **165**, 655.

Fujii, M. See Miyamoto et al., Measurement of the Location of the X-Ray Source Cygnus X-1, **168**, L11.

Fujimoto, M. Nonlinear Motions of Rotating Gaseous Ellipsoids, **170**, 143.

Fullerton, Wayne, and Cowley, Charles R. Calculations of van der Waals Broadening for Lines of Astrophysical Interest, **165**, 643.

Fymat, A. L. See Abhyankar and Fymat, Tables of Auxiliary Functions for the Nonconservative Rayleigh Phase Matrix in Semi-infinite Atmospheres, **165**, 673; Suppl., **23**, 35 (No. 195).

Gabriel, A. H., Garton, W. R. S., Goldberg, L., Jones, T. J. L., Jordan, Carole, Morgan, F. J., Nicholls, R. W., Parkinson, W. J., Paxton, H. J. B., Reeves, E. M., Shenton, C. B., Speer, R. J., and Wilson, R. Rocket Observations of the Ultraviolet Solar Spectrum during the Total Eclipse of 1970 March 7, **169**, 595.

Gardner, F. F., Ribes, J. C., and Sinclair, M. W. Observations of the $^2\Pi_{1/2}$, $J = 1/2$ Line of OH at 4660 MHz in Sagittarius B2, **169**, L109.

Garmire, G. See Neugebauer et al., Infrared Observations on the Size of NGC 1068, **166**, L45.

Garmire, Gordon. See Spinrad et al., Maffei 1: A New Massive Member of the Local Group?, **163**, L25.

Garmire, G. P. See Loh and Garmire, Radiative Transfer in an Ionized Medium at High Temperature, **166**, 301; Erratum, **169**, 447.

Garton, W. R. S. See Connerade et al., Absorption Spectrum of Na I in the Vacuum Ultraviolet, **165**, 203.

———. See Gabriel et al., Rocket Observations of the Ultraviolet Solar Spectrum during the Total Eclipse of 1970 March 7, **169**, 595.

Gaustad, J. E. See Cudaback et al., Silicon

XUM

Monoxide in the Infrared Spectrum of Alpha Orionis, **166**, L49.
Geballe, T. R. See Holtz et al., Infrared Line Emission from Planetary Nebulae, **164**, L29.
Gebbie, K. B., and Thomas, R. N. The Temperature Control Bracket, **168**, 461.
Gehrels, T. See Cocke et al., Upper Limit to Circular Polarization of Optical Pulsar NP 0532, **169**, L119.
Gehrz, R. D. See Dyck et al., Visual Intrinsic Polarization and Infrared Excess of Cool Stars, **165**, 57.
Gehrz, R. D., and Woolf, N. J. Mass Loss from M Stars, **165**, 285.
Geldon, Fred M. See Steigman et al., Ionization Equilibrium of Interstellar Nitrogen: A Probe for the Intercloud Medium?, **168**, 373.
Gerlach, Ulrich H. Optical Appearance of a Collisionless Gas of Stars Surrounding a Black Hole, **168**, 481.
Giacconi, R. See Gursky et al., Detection of X-Rays from the Seyfert Galaxies NGC 1275 and NGC 4151 by the *Uhuru* Satellite, **165**, L43.
———. See Gursky et al., A Strong X-Ray Source in the Coma Cluster Observed by *Uhuru*, **167**, L81.
———. See Kellogg et al., X-Ray Observations of the Virgo Cluster, NGC 5128, and 3C 273 from the *Uhuru* Satellite, **165**, L49.
———. See Kellogg et al., X-Ray Sources near the Galactic Center Observed by *Uhuru*, **169**, L99.
———. See Leong et al., X-Ray Emission from the Magellanic Clouds Observed by *Uhuru*, **170**, L67.
———. See Oda et al., X-Ray Pulsations from Cygnus X-1 Observed from *Uhuru*, **166**, L1.
———. See Schreier et al., Further Observations of the Pulsating X-Ray Source Cygnus X-1 from *Uhuru*, **170**, L21.
———. See Tananbaum et al., Measurement of the Location of the X-Ray Sources Cygnus X-1 and Cygnus X-2 from *Uhuru*, **165**, L37.
———. See Tananbaum et al., X-Ray Observations of GX 17+2 from *Uhuru*, **168**, L25.
Giacconi, R., Gursky, H., Kellogg, E., Schreier, E., and Tananbaum, H. Discovery of Periodic X-Ray Pulsations in Centaurus X-3 from *Uhuru*, **167**, L67.
Giacconi, R., Kellogg, E., Gorenstein, P., Gursky, H., and Tananbaum, H. An X-Ray Scan of the Galactic Plane from *Uhuru*, **165**, L27.
Gillett, F. C. See Dyck et al., Visual Intrinsic Polarization and Infrared Excess of Cool Stars, **165**, 57.
———. See Forrest et al., Variability of Radiation from Circumstellar Grains Surrounding R Coronae Borealis, **170**, L29.
Gillett, F. C., Knacke, R. F., and Stein, W. A. Infrared Studies of Galactic Nebulae. II. The Compact Nebulae IC 4997, VV 8, and FG Sagittae, **163**, L57.
Gillett, F. C., Merrill, K. M., and Stein, W. A. Observations of Infrared Radiation from Cool Stars, **164**, 83.
Gillett, F. C., and Stein, W. A. Infrared Studies of Galactic Nebulaé. II. B Stars Associated with Nebulosity, **164**, 77.
Giuli, R. T. See Moss and Giuli, The Modulation of Galactic Protons by the Solar Wind: A Monte Carlo Approach, **167**, 331.
Glaspey, John W. Am Stars as Possible Members of Two Subgroups of the Scorpius-Centaurus Association, **169**, 525.
Goldberg, L. See Gabriel et al., Rocket Observations of the Ultraviolet Solar Spectrum during the Total Eclipse of 1970 March 7, **169**, 595.
Golden, Lawrence B. See Sampson and Golden, Semiempirical Cross-Sections and Rates for Excitation and for Ionization of Hydrogenic Ions by Electron Impact, **170**, 169.
Golden, Lawrence B., and Sampson, Douglas H. Electron-Impact Cross-Sections and Rates for $nl \rightarrow n'l'$ Transitions in Hydrogenic Ions and Hydrogen, **170**, 181.
———. Semiempirical Cross-Sections and Rates for Excitation and Ionization of

Hydrogen by Electron Impact, **163**, 405.

Goldreich, Peter, and Keeley, D. A. Coherent Synchrotron Radiation, **170**, 463.

Goldsmith, D. W. See Habing and Goldsmith, Heating of the Interstellar Medium by X-Rays and by Cosmic Rays, **166**, 525.

Goldsmith, Samuel. See Bahcall and Goldsmith, On the Absorption-Line Spectrum of 4C 05.34, **170**, 17.

Goldstein, Bruce E. See Lazarus and Goldstein, Observation of the Angular-Momentum Flux Carried by the Solar Wind, **168**, 571.

Goldstein, Melvyn L., and Lenchek, Allen M. The Theory of Inverse Compton Scattering in a Cold Plasma, **163**, 515.

Goldwire, H. C., Jr. See Predmore et al., Limiting ^{3}He Abundances in Four H II Regions, **168**, L125.

Gordon, Kurtiss J. A 21-Centimeter Study of the Spiral Galaxy Messier 33, **169**, 235.

Gordon, M. A. Radiation Transfer of Radio Recombination Lines in the Diffuse Interstellar Medium, **167**, 21.

———. See Hjellming and Gordon, Radio Recombination Lines and Non-LTE Theory: A Reanalysis, **164**, 47.

———. See Manchester and Gordon, Excitation Temperatures of the 18-Centimeter OH Transitions in an Absorbing Cloud, **169**, 507.

Gordon, M. A., and Gottesman, S. T. Electron Density and Temperature in the Diffuse Interstellar Medium Determined from Recombination Lines, **168**, 361.

Gordon, M. A., and Roberts, M. S. The Absence of Formaldehyde Radiation toward Cold Regions of the Galactic Plane, **170**, 277.

Gordon, M. A., and Wallace, D. C. Physical Characteristics of W49A as Determined from Radio Recombination Lines, **167**, 235.

Gorenstein, P. See Giacconi et al., An X-Ray Scan of the Galactic Plane from *Uhuru*, **165**, L27.

———. See Gursky et al., The Estimated Distance to Cygnus X-1 Based on Its Low-Energy X-Ray Spectrum, **167**, L15.

———. See Oda et al., X-Ray Pulsations from Cygnus X-1 Observed from *Uhuru*, **166**, L1.

Goss, W. M. See Radhakrishnan et al., The Parkes Survey of 21-Centimeter Absorption in Discrete-Source Spectra. I. The Parkes Hydrogen-Line Interferometer, **170**, 617.

———. See Radhakrishnan et al., The Parkes Survey of 21-Centimeter Absorption in Discrete-Source Spectra. III. 21-Centimeter Absorption Measurements on 41 Galactic Sources North of Declination −48°, **170**, 617.

———. See Radhakrishnan and Goss, The Parkes Survey of 21-Centimeter Absorption in Discrete-Source Spectra. V. Note on the Statistics of Absorbing H I Concentrations in the Galactic Disk, **170**, 617.

Goss, W. M., Radhakrishnan, V., Brooks, J. W., and Murray, J. D. The Parkes Survey of 21-Centimeter Absorption in Discrete-Source Spectra. IV. 21-Centimeter Absorption Measurements on Low-Latitude Sources South of Declination −46°, **170**, 617.

Gott, J. Richard, III. See Wrixon et al., Absolute Measurements of the Flux of Cassiopeia A and Taurus A at 1.87 Centimeters, **165**, 23.

Gott, J. Richard, III, and Gunn, James E. The Coma Cluster as an X-Ray Source: Some Cosmological Implications, **169**, L13.

Gottesman, S. T. See Gordon and Gottesman, Electron Density and Temperature in the Diffuse Interstellar Medium Determined from Recombination Lines, **168**, 361.

Gottlieb, C. A. See Ball et al., Search for Extraterrestrial $H_2{}^{18}O$ Emission, **163**, 429.

Gottlieb, Carl A. See Ball et al., Search for the $^2\Pi_{1/2}$, $J = 5/2$ Excited State of OH in W3, **163**, L33.

———. See Zuckerman et al., Microwave Detection of Interstellar Formic Acid, **163**, L41.

Gower, A. C. See Hutchings et al., Ultrarapid Activity at Hα in the Spectra of Be Stars, **170**, L73.
Graboske, H. C., Jr. See Grossman and Graboske, Evolution of Low-Mass Stars. III. Effects of Nonideal Thermodynamic Properties during the Pre-Main-Sequence Contraction, **164**, 475.
Graboske, H. C., Jr., and Grossman, A. S. Evolution of Low-Mass Stars. IV. Effects of Multilevel Atomic Partition Functions for the Ideal-Gas Region, **170**, 363.
Grader, R. J. See Palmieri et al., Diffuse Cosmic X-Ray Flux from 0.2 to 2 keV, **169**, 33.
———. See Palmieri et al., Soft X-Rays from Two Supernova Remnants, **164**, 61.
———. See Seward et al., X-Rays from Puppis A and the Vicinity of Vela X, **169**, 515.
Grasdalen, Gary. See Lampton et al., Simultaneous Radio and Optical Measurements of Scorpius XR-1, **164**, L61.
Grayzeck, E. J. See Gursky et al., The Estimated Distance to Cygnus X-1 Based on Its Low-Energy X-Ray Spectrum, **167**, L15.
Greenberg, Philip J. The Post-Newtonian Equations of Hydrodynamics for a Thermally Conducting, Viscous, Compressible Fluid in General Relativity, **164**, 569.
———. The Post-Newtonian Equations of Magnetohydrodynamics in General Relativity, **164**, 589.
Greene, Arthur E., and Wing, Robert F. A Brightening of the Ultraviolet Spectrum of the Carbon Star HD 59643, **163**, 309.
Greenstein, Jesse L. See Branch and Greenstein, The 1961 Supernova in NGC 1058, **167**, 89.
Greenstein, Jesse L., Gunn, James E., and Kristian, Jerome. Spectra of White Dwarfs with Circular Polarization, **169**, L63.
Greenstein, J. L., Oke, J. B., and Shipman, H. L. Effective Temperature, Radius, and Gravitational Redshift of Sirius B, **169**, 563.
Grossman, A. S. See Graboske and Grossman, Evolution of Low-Mass Stars. IV. Effects of Multilevel Atomic Partition Functions for the Ideal-Gas Region **170**, 363.
Grossman, A. S., and Graboske, H. C., Jr. Evolution of Low-Mass Stars. III. Effects of Nonideal Thermodynamic Properties during the Pre-Main-Sequence Contraction, **164**, 475.
Groth, Edward J. See Horowitz et al., Optical Time-of-Arrival Measurements from the Crab Pulsar: Comparison of Results from Four Observatories, **166**, L91.
Groves, D. J. See Price et al., X-Rays from the Magellanic Clouds, **168**, L7.
Gull, T. R., and Harwit, M. O. A Search for Near-Infrared Emission of Interstellar Molecular Hydrogen, **168**, 15.
Gunn, James E. On the Distances of the Quasi-stellar Objects, **164**, L113.
———. See Gott and Gunn, The Coma Cluster as an X-Ray Source: Some Cosmological Implications, **169**, L13.
———. See Greenstein et al., Spectra of White Dwarfs with Circular Polarization, **169**, L63.
———. See Ostriker and Gunn, Do Pulsars Make Supernovae?, **164**, L95.
———. See Spinrad et al., Color Changes and Absorption-Line Variations over the Inner Disk of M31 and the Central Regions of M32 and NGC 4472, **164**, 11.
———. See Spinrad et al., Maffei 1: A New Massive Member of the Local Group?, **163**, L25.
Gunn, James E., and Ostriker, Jeremiah P. On the Motion and Radiation of Charged Particles in Strong Electromagnetic Waves. I. Motion in Plane and Spherical Waves, **165**, 523.
Gursky, H. See Giacconi et al., Discovery of Periodic X-Ray Pulsations in Centaurus X-3 from *Uhuru*, **167**, L67.
———. See Giacconi et al., An X-Ray Scan of the Galactic Plane from *Uhuru*, **165**, L27.
———. See Kellogg et al., X-Ray Observations of the Virgo Cluster, NGC 5128, and 3C 273 from the *Uhuru* Satellite,

165, L49.
———. See Kellogg et al., X-Ray Sources near the Galactic Center Observed by *Uhuru*, **169**, L99.
———. See Leong et al., X-Ray Emission from the Magellanic Clouds Observed by *Uhuru*, **170**, L67.
———. See Oda et al., X-Ray Pulsations from Cygnus X-1 Observed from *Uhuru*, **166**, L1.
———. See Schreier et al., Further Observations of the Pulsating X-Ray Source Cygnus X-1 from *Uhuru*, **170**, L21.
———. See Tananbaum et al., Measurement of the Location of the X-Ray Sources Cygnus X-1 and Cygnus X-2 from *Uhuru*, **165**, L37.
———. See Tananbaum et al., X-Ray Observations of GX 17+2 from *Uhuru*, **168**, L25.
Gursky, H., Gorenstein, P., Kerr, F. J., and Grayzeck, E. J. The Estimated Distance to Cygnus X-1 Based on Its Low-Energy X-Ray Spectrum, **167**, L15.
Gursky, H., Kellogg, E. M., Leong, C., Tananbaum, H., and Giacconi, R. Detection of X-Rays from the Seyfert Galaxies NGC 1275 and NGC 4151 by the *Uhuru* Satellite, **165**, L43.
Gursky, H., Kellogg, E., Murray, S., Leong, C., Tananbaum, H., and Giacconi, R. A Strong X-Ray Source in the Coma Cluster Observed by *Uhuru*, **167**, L81.
Guthrie, P. D. See Pollack et al., On the Absorption of Gamma Rays by Photons in Pulsars, Quasi-stellar Objects, and Other Source Objects, **169**, L113.

Habing, H. J., and Goldsmith, D. W. Heating of the Interstellar Medium by X-Rays and by Cosmic Rays, **166**, 525.
Hackney, Karen R. See Folsom et al., Optical Changes in Eleven Ohio Radio Sources with Unusual Spectra, **169**, L131.
Hackney, R. L. See Folsom et al., Optical Changes in Eleven Ohio Radio Sources with Unusual Spectra, **169**, L131.
Haggerty, M. J. A Newtonian Model for the Creation of a Hierarchical Cosmology, **166**, 257.
Hankins, T. H. Microsecond Intensity Variations in the Radio Emissions from CP 0950, **169**, 487.
Hanner, Martha S. Light from Reflection Nebulae. IV. Scattering by Silicate Grains, **164**, 425.
Hansen, Carl J. Element Production in Simple Helium Burning, **169**, 585.
Hansen, Carl J., and Spangenberg, William H. Equilibrium and Pulsational Properties of the Lower Helium Main Sequence, **168**, 71.
Hansen, Carl J., and Zaidins, Clyde S. The Rate of the $^{12}C + {}^{16}O$ Reaction, **168**, 317.
Hansen, C. J., and Spangenberg, W. Pulsational Stability of Pure-Helium Stars of Low Mass, **163**, 653.
Hansen, R. O. The Stability of Precessing Elliptical Orbits in a Schwarzschild Field, **170**, 557.
Hantel, E. G. See Cowan and Hantel, The Possibility of Fission Multiplication in Supernovae Following the *r*-Process, **167**, 101.
Hardebeck, Ellen G. Accurate Position Measurements in the 1720-MHz Line of OH, **170**, 281.
Hardebeck, Ellen G., and Wilson, William J. Position Measurements of Main-Line OH/Infrared Stars, **169**, L123.
Harper, D. A., and Low, F. J. Far-Infrared Emission from H II Regions, **165**, L9.
Harris, William E., and Clement, Maurice J. Differential Rotation in Stars on the Upper Main Sequence. II, **167**, 321.
Hart, Michael H. See Spitzer and Hart, Random Gravitational Encounters and the Evolution of Spherical Systems. I. Method, **164**, 399.
———. See Spitzer and Hart, Random Gravitational Encounters and the Evolution of Spherical Systems. II. Models, **166**, 483.
Harten, A. See Cuperman and Harten, The Electron Temperature in the Two-Component Solar Wind, **163**, 383.
———. See Cuperman and Harten, The Radial Electric Field in the Solar Wind, **169**, 165.
Hartle, R. E. See Barnes et al., On the

Energy Transport in Stellar Winds, **166**, L53.
Hartwick, F. D. A. Abundance Ratios from the Absorption Spectrum of the Quasar PKS 0237–23, **170**, L127.
———. On the Rate of Star Formation in M31, **163**, 431.
———. See Arp and Hartwick, A Photometric Study of the Metal-rich Globular Cluster M71, **167**, 499.
Harvey, Gale A. The Calcium H- and K-Line Anomaly in Meteor Spectra, **165**, 669.
Harwit, Martin. See Houck et al., Rocket-Infrared Four-Color Photometry of the Galaxy's Central Regions, **169**, L31.
———. See Soifer et al., Rocket-Infrared Observations of the Interplanetary Medium, **168**, L73.
Harwit, M. O. See Gull and Harwit, A Search for Near-Infrared Emission of Interstellar Molecular Hydrogen, **168**, 15.
Hazlehurst, J. See Jackson et al., Stellar Rotation: A Comparison of Recent Results, **165**, 223.
Hearnshaw, J. B. The Old Disk Metal-rich Subgiant 31 Aquilae, **168**, 109.
Heasley, James N., Jr. The Apsidal-Motion Test for Late-Type Stars, **163**, 345.
———. See Demarque and Heasley, A Method for the Simultaneous Determination of Helium and Metal Abundances in Old Open Clusters, **163**, 547.
Hecht, Hartmut F. The Electron-Neutrino Cross-Section and Its Effect on the Cosmological Helium Abundance, **170**, 401.
Heeschen, D. S., Morgan, W. W., and Walborn, N. R. The Distribution of Light in the Central Regions of Some Giant Elliptical Galaxies, **165**, L65.
Heil, Timothy G., and Schaefer, Henry F., III. Four New Bound, Low-Lying States of Cyanogen: $^4\Sigma^+$, $^4\Sigma^-$, $^4\Pi$, $^4\Delta$, **163**, 425.
Heiles, Carl. See Rankin et al., Pulsar NP 0532: Disappearance of the Precursor Pulse at 606 MHz, **163**, L95.
———. See Turner and Heiles, Nonthermal OH Emission in Interstellar Dust Clouds, **170**, 453.
Held, S. New Even Levels of Er I, **167**, 203.
———. See Spector and Held, Description of the Erbium Spectra in the Photographic Infrared, **167**, 193.
Henriksen, R. N. See Chau et al., Evolution of a Stabilized Oblique Rotator: Behavior over Short and Long Time Scales, **168**, L79.
Henry, R. C. See Rottman et al., Lyman-Alpha Emission from Arcturus, **165**, 661.
Henry, Richard C. See Fritz et al., The X-Ray Spectra of the Crab Nebula and NP 0532, **164**, L55.
———. See Hesser and Henry, K-Line Photometry of Stars in Population I Clusters, **169**, 633; Suppl., **23**, 453 (No. 202).
———. See Shulman et al., Line Emission in the X-Ray Background, **166**, L9.
———. See Weber et al., Far-Ultraviolet Interstellar Absorption in Orion and Monoceros, **166**, 543.
Henry, Richard C., Fritz, Gilbert, Meekins, John F., Chubb, Talbot, and Friedman, H. Excess Background Radiation of Soft X-Rays at the Galactic Pole and Plane, **163**, L73.
Henry, Richard C., and Hesser, James E. K-Line Photometry of Southern A Stars, **169**, 633; Suppl., **23**, 421 (No. 202).
Henry, Ronald J. W. See Chapman and Henry, Photoionization Cross-Sections for Atoms and Ions of Sulfur, **168**, 169.
Herbig, G. H. The Spectrum of LkHα-101 in the Near-Infrared, **169**, 537.
Herrero, V., Hjellming, R. M., and Wade, C. M. Radio Observations of Nova Scuti 1970, **166**, L19.
Hesser, James E. See Henry and Hesser, K-Line Photometry of Southern A Stars, **169**, 633; Suppl., **23**, 421 (No. 202).
———. See Lasker and Hesser, High-Frequency Stellar Oscillations. V. Power Spectra for the Central Stars of Planetary Nebulae, **164**, 303.
———. See Lasker and Hesser, High-Fre-

quency Stellar Oscillations. VI. R548, a Periodically Variable White Dwarf, **163**, L89.

Hesser, James E., and Henry, Richard C. K-Line Photometry of Stars in Population I Clusters, **169**, 633; Suppl., **23**, 453 (No. 202).

Hewish, A. The Spectrum of Plasma-Density Irregularities in the Solar Wind, **163**, 645.

Hill, Graham. See Hutchings and Hill, The Synthesis of Close-Binary Light Curves. II. Double Distortion and the Systems AS Eridani, Lambda Tauri, and RS Vulpeculae, **166**, 373; Addendum, **169**, 635.

———. See Hutchings and Hill, The Synthesis of Close-Binary Light Curves. III. The Hot Ellipsoidal Variables Psi Orionis and AO Cassiopeiae and Evolutionary State of Six Systems, **167**, 137.

Hill, Graham, Barnes, J. V., Hutchings, J. B., and Pearce, J. A. A Spectroscopic Study of Algol, **168**, 443.

Hill, R. W. See Palmieri et al., Diffuse Cosmic X-Ray Flux from 0.2 to 2 keV, **169**, 33.

———. See Palmieri et al., Soft X-Rays from Two Supernova Remnants, **164**, 61.

———. See Seward et al., X-Rays from Puppis A and the Vicinity of Vela X, **169**, 515.

Hills, Richard. See Horowitz et al., Optical Time-of-Arrival Measurements from the Crab Pulsar: Comparison of Results from Four Observatories, **166**, L91.

Hiltner, W. A. See Mook et al., Spectroscopic Observations of Scorpius X-1, **163**, L69.

Hjellming, R. M. See Andrews et al., Non-LTE Analysis of Data on Radio Recombination Lines for Five H II Regions, **167**, 245.

———. See Herrero et al., Radio Observations of Nova Scuti 1970, **166**, L19.

———. See Wade and Hjellming, Detection of Radio Emission from Antares, **163**, L105.

———. See Wade and Hjellming, Further Radio Observations of Novae, **163**, L65.

———. See Wade and Hjellming, Further Radio Observations of Scorpius X-1, **170**, 523.

———. See Wade et al., Radio Emission from the Nucleus of NGC 5128, **170**, L11.

Hjellming, R. M., and Gordon, M. A. Radio Recombination Lines and Non-LTE Theory: A Reanalysis, **164**, 47.

Hjellming, R. M., and Wade, C. M. Radio Emission from Antares B, **168**, L115.

———. Radio Emission from X-Ray Sources, **168**, L21.

———. The Radio Sources Associated with Scorpius X-1, **164**, L1.

Hobbs, L. M. A Comparison of the Interstellar 21-Centimeter and Sodium D-Lines, **166**, 333.

———. Observations of Interstellar Ca I Lines, **170**, L85.

Hobbs, Robert W., and Marionni, Paul. Search for 3.5-Millimeter Continuum Radiation from Infrared Stars and Related Objects, **167**, 85.

Hobbs, Robert W., Modali, Sarma B., and Maran, Stephen P. Evidence for an Optically Thick Component in the Galactic Radio Source Sagittarius B_2, **165**, L87.

Hobbs, R. W., and Johnston, K. J. Observations of Seven Compact Sources in H II Regions at Wavelengths of 0.95, 1.65, and 2.73 Centimeters, **163**, 299.

Hodge, Philip M. See Burbidge and Hodge, Is NGC 4569 a Member of the Virgo Cluster?, **166**, 1.

Hoffman, Herbert S. Ionic Spectra of Meteors, **163**, 393.

Hoffmann, William F., Frederick, Carl L., and Emery, Roger J. 100-Micron Map of the Galactic-Center Region, **164**, L23.

———. 100-Micron Survey of the Galactic Plane, **170**, L89.

Höglund, Bertil. See Seielstad et al., A Search for Redshifted Neutral Hydrogen in 3C 48 and Other Compact Objects, **170**, 219.

Hohl, Frank. Numerical Experiments with a Disk of Stars, **168**, 343.

XUM

Hollenbach, David, and Salpeter, E. E. Surface Recombination of Hydrogen Molecules, **163**, 155.

Hollenbach, David, Werner, Michael W., and Salpeter, E. E. Molecular Hydrogen in H I Regions, **163**, 165.

Holt, S. S. See Boldt et al., A Limit on Line Emission in the X-Ray Background at High Galactic Latitudes, **167**, L1.

———. See Boldt et al., Search for Temporal Structure in X-Rays from Scorpius X-1, **164**, L9.

Holt, S. S., Boldt, E. A., Schwartz, D. A., Serlemitsos, P. J., and Bleach, R. B. Evidence for Multiple Periodicity in the X-Ray Emission from Cygnus X-1, **166**, L65.

Holtz, J. Z., Geballe, T. R., and Rank, D. M. Infrared Line Emission from Planetary Nebulae, **164**, L29.

Horowitz, P. See Elliot et al., A Search for an Optical Source at the Position of Centaurus XR-3, **168**, L95.

Horowitz, P., Papaliolios, C., and Carleton, N. P. Results of a Search for Optical Pulsars, **163**, L5.

Horowitz, Paul, Papaliolios, Costas, Carleton, Nathaniel, Nelson, Jerry, Middleditch, John, Hills, Richard, Cudaback, David, Wampler, Joseph, Boynton, Paul E., Groth, Edward J., Partridge, R. Bruce, Wilkinson, David T., Duthie, J. Graeme, and Murdin, Paul. Optical Time-of-Arrival Measurements from the Crab Pulsar: Comparison of Results from Four Observatories, **166**, L91.

Houck, J. R. See Soifer et al., Rocket-Infrared Observations of the Interplanetary Medium, **168**, L73.

Houck, J. R., Soifer, B. T., Pipher, Judith L., and Harwit, Martin. Rocket-Infrared Four-Color Photometry of the Galaxy's Central Regions, **169**, L31.

House, Lewis L. See Blake and House, Solar Suprathermal Event Deduced from X-Ray Lines, **166**, 423.

———. See Wagner and House, Empirically Corrected Calculations of Coronal Visible Lines from the $3p^5$ 3d Configuration, **166**, 683.

Howard, W. M., Arnett, W. David, and Clayton, Donald D. Explosive Nucleosynthesis in Helium Zones, **165**, 495.

Hsieh, K. C., Mason, G. M., and Simpson, J. A. Cosmic-Ray ^{2}H from Satellite Measurements, 1965 to 1969, **166**, 221.

Huang, Su-Shu. Transfer of Radiation in Circumstellar Dust Envelopes. III. The Case of Distant Envelopes, **164**, 91.

Hubbard, W. B., and Slattery, Wayne L. Statistical Mechanics of Light Elements at High Pressure. I. Theory and Results for Metallic Hydrogen with Simple Screening, **168**, 131.

Hube, Joan O. See Fernie and Hube, On the Existence of Stable Stars in the Cepheid Instability Strip, **168**, 437.

Hudson, Hugh S. See Teske et al., Type III Solar Radio Bursts Accompanied by Soft X-Radiation in the Absence of Hα Flares, **165**, 615.

Hudson, Katherine I. See Abt and Hudson, Rotational Velocities in Short-Period A-Type Binaries, **163**, 333.

Hudson, Katherine I., Chiu, Hong-Yee, Maran, Stephen P., Stuart, Frank E., and Vokac, Peter R. Automated and Conventional Photometry of the Short-Period Variable Star 14 Aurigae, **165**, 573.

Hughes, M. P., Thompson, A. R., and Colvin, R. S. An Absorption-Line Study of the Galactic Neutral Hydrogen at 21 Centimeters Wavelength, **168**, 579; Suppl., **23**, 323 (No. 200).

Hughes, V. A., Feldman, P. A., and Woodsworth, A. Radio Observations of Magnetic White Dwarfs, **170**, L125.

Huguenin, G. R. See Taylor and Huguenin, Observations of Rapid Fluctuations of Intensity and Phase in Pulsar Emissions, **167**, 273.

Huguenin, G. R., Manchester, R. N., and Taylor, J. H. Properties of Pulsars, **169**, 97.

Humphreys, Roberta M. Streaming Motions in the Carina-Centaurus Region, **163**, L111.

Humphreys, Roberta M., Strecker, Donald W., and Ney, E. P. High-Luminosity G Supergiants, **167**, L35.

Hunter, C. E., and Donn, B. The Effect of Methane, Ammonia, and Silicates on the 3.07-Micron Ice Absorption in Interstellar Grains, **167**, 71.

Hunter, James H., Jr. Generalized Thermal Stability and Its Application to the Interstellar Gas, **166**, 453.

Hutchings, J. B. See Hill et al., A Spectroscopic Study of Algol, **168**, 443.

Hutchings, J. B., Auman, J. R., Gower, A. C., and Walker, G. A. H. Ultrarapid Activity at Hα in the Spectra of Be Stars, **170**, L73.

Hutchings, J. B., and Hill, Graham. The Synthesis of Close-Binary Light Curves. II. Double Distortion and the Systems AS Eridani, Lambda Tauri, and RS Vulpeculae, **166**, 373; Erratum, **169**, 635.

———. The Synthesis of Close-Binary Light Curves. III. The Hot Ellipsoidal Variables Psi Orionis and AO Cassiopeiae and Evolutionary State of Six Systems, **167**, 137.

Hutchison, Robert B. Turbulence Velocities in the Atmosphere of Alpha Orionis, **170**, 551.

Hyland, A. R. See Penston et al., The Nature of Becklin's Star, **170**, L33.

Iben, Icko, Jr. A Conjecture concerning the Transition Period for Variable Stars, **168**, 225.

———. On the Specification of the Blue Edge of the RR Lyrae Instability Strip, **166**, 131.

———. See Abraham and Iben, More Solar Models and Neutrino Fluxes, **170**, 157.

Ingersoll, Andrew P. Polarization Measurements of Mars and Mercury: Rayleigh Scattering in the Martian Atmosphere, **163**, 121.

Ingersoll, Andrew P., and Spiegel, Edward A. Temperature Variation and the Solar Oblateness, **163**, 375.

Ipser, James R. Gravitational Radiation from Slowly Rotating, Fully Relativistic Stars, **166**, 175.

Jackson, P. D., and Kerr, F. J. Detection of Radio Recombination-Line Emission Associated with Distributed Ionized Hydrogen, **168**, 29.

Jackson, Stephen, Sanderson, A. D., Smith, R. Connon, and Hazlehurst, J. Stellar Rotation: A Comparison of Recent Results, **165**, 223.

James, K. A., and McClure, Robert D. Strong-Cyanogen Stars: Photometry and Kinematics, **165**, 561.

Jauncey, D. L. See Cohen et al., The Small-Scale Structure of Radio Galaxies and Quasi-stellar Sources at 3.8 Centimeters, **170**, 207.

———. See Kellermann et al., High-Resolution Observations of Compact Radio Sources at 6 and 18 Centimeters, **169**, 1.

Jefferts, K. B. See Kutner et al., Observation of 140-GHz Formaldehyde Line Emission from the Trapezium Region of the Orion Nebula, **164**, L49.

———. See Penzias et al., Interstellar Carbon Monosulfide, **168**, L53.

———. See Penzias et al., Interstellar $^{12}C^{16}O$, $^{13}C^{16}O$, and $^{12}C^{18}O$, **165**, 229.

———. See Solomon et al., Detection of Millimeter Emission Lines from Interstellar Methyl Cyanide, **168**, L107.

———. See Thaddeus et al., Discovery of Para-Formaldehyde and the 2-Millimeter Formaldehyde Distribution in the Orion Infrared Nebula, **168**, L59.

———. See Wilson et al., Discovery of Interstellar Silicon Monoxide, **167**, L97.

———. See Wilson et al., Millimeter Observations of CO, CN, and CS Emission from IRC+10216, **169**, L35.

Jefferts, K. B., Penzias, A. A., Wilson, R. W., and Solomon, P. M. Detection of Interstellar Carbonyl Sulfide, **168**, L111.

Jefferts, Keith B. See Solomon et al., Observation of CO Emission at 2.6 Millimeters from IRC+10216, **163**, L53.

Jenkins, Edward B. A Closer Look at Interstellar Lyman-Alpha Absorption, **169**, 25.

Jenner, David C. See Ford and Jenner, Dust across Maffei 1, **165**, L1.

XUM

Johnson, Donald R., and Lovas, Frank. A New Look at the Laboratory Microwave Spectrum of Cyanoacetylene, **169**, 617.
Johnson, H. E., and Axford, W. I. Galactic Winds, **165**, 381.
Johnson, Hugh M. Hβ Photometry of the Night Sky, **164**, 379.
———. Radiofrequency Observations of Symmetric Nebulae around Wolf-Rayet Stars and an O7f Star, **167**, 491.
———. The Sky near the Brightest X-Ray Source in Scorpius. III, **164**, 67.
Johnson, Hugh M., and Rubin, Robert H. Observation and Classification of the Nebula YM 29, **163**, 151.
Johnson, Torrence V. See McCord et al., Saturn and Its Satellites: Narrow-Band Spectrophotometry (0.3-1.1 μ), **165**, 413.
Johnson, Torrence V., and McCord, Thomas B. Spectral Geometric Albedo of the Galilean Satellites, 0.3 to 2.5 Microns, **169**, 589.
Johnston, K. J. See Hobbs and Johnston, Observations of Seven Compact Sources in H II Regions at Wavelengths of 0.95, 1.65, and 2.73 Centimeters, **163**, 299.
Johnston, K. J., Knowles, S. H., and Sullivan, W. T., III. Observations of 1.35-Centimeter H_2O Emission in the Southern Hemisphere, **167**, L93.
Johnston, K. J., Knowles, S. H., Sullivan, W. T., III, Moran, J. M., Burke, B. F., Lo, K. Y., Papa, D. C., Papadopoulos, G. D., Schwartz, P. R., Knight, C. A., Shapiro, I. I., and Welch, W. J. An Interferometer Map of the Water-Vapor Sources in W49, **166**, L21.
Jokipii, J. R. See Owens and Jokipii, Cosmic-Ray Modulation by an Angle-dependent Solar Wind, **167**, 169.
Jones, Frank C. A Dynamic Equation for Stochastic Magnetic Field Lines in the Galaxy, **169**, 477.
———. Suprathermal Proton Bremsstrahlung by the Weizsäcker-Williams Method, **169**, 503.
Jones, Harrison P. The Formation of Resonance Lines in Multidimensional Media. I. Scaling Properties in Two Dimensions, **164**, 341.
Jones, T. J. L. See Gabriel et al., Rocket Observations of the Ultraviolet Solar Spectrum during the Total Eclipse of 1970 March 7, **169**, 595.
Jordan, Carole. See Gabriel et al., Rocket Observations of the Ultraviolet Solar Spectrum during the Total Eclipse of 1970 March 7, **169**, 595.
Joshi, S. K. See Mathur et al., Cross-Sections and Reaction Rates for Electron-Impact Ionization of Lithiumlike and Sodiumlike Positive Ions, **165**, 425.
Julienne, P. S., Krauss, M., and Donn, B. Formation of OH through Inverse Predissociation, **170**, 65.

Kafatos, Minas C., and Morrison, Philip. Fossil Strömgren Spheres from Supernova Explosions, **168**, 195.
Kahler, S. On the Existence of Solar-Flare Plasmas of $T \gtrsim 10^{8}$ ° K, **164**, 365; Erratum, **168**, 319.
Kahler, S. W., and Kreplin, R. W. The Observation of Nonthermal Solar X-Radiation in the Energy Range $3 < E < 10$ keV, **168**, 531.
Kalaghan, P. M., and Telford, L. E. Radio Observations of Mars at 8.57 Millimeters, **170**, L77.
Kaler, J. B. See Cahn and Kaler, The Distances and Distribution of Planetary Nebulae, **163**, 207; Suppl., **22**, 319 (No. 189).
———. See Czyzak et al., Spectrophotometric Studies of Gaseous Nebulae. XIX. The Moderate-Excitation Planetary NGC 6826, **168**, 405.
Kaler, J. B., Czyzak, S. J., and Aller, L. H. Line Intensities in NGC 7027, **169**, 199.
Kaler, J. B., Lee, P., and Aller, L. H. The Continuous Spectrum of Neutral Helium from Gaseous Nebulae, **163**, 141.
Kalnajs, Agris J. Dynamics of Flat Galaxies. I, **166**, 275.
Kane, S. R. An Upper Limit on the Hardness of the Nonthermal Electron Spectra Produced during the Flash Phase of Solar Flares, **170**, 587.
Kane, S. R., and Donnelly, R. F. Impulsive

Hard X-Ray and Ultraviolet Emission during Solar Flares, **164**, 151.
Kashy, E. See Austin et al., Energy of the Second Excited State of ^{12}C and the Rate of the Triple-Alpha Reaction, **163**, L79.
Kattawar, George W., and Adams, Charles N. Flux and Polarization Reflected from a Rayleigh-scattering Planetary Atmosphere, **167**, 183.
Kattawar, George W., Plass, Gilbert N., and Adams, Charles N. Flux and Polarization Calculations of the Radiation Reflected from the Clouds of Venus, **170**, 371.
Keeley, D. A. See Goldreich and Keeley, Coherent Synchrotron Radiation, **170**, 463.
Kelleher, D. E. See Wiese and Kelleher, On the Cause of the Redshifts in White-Dwarf Spectra, **166**, L59.
Keller, C. F., and Mutschlecner, J. P. Hydrodynamic Envelopes of Classical Cepheid Variables, **167**, 127.
Kellermann, K. I. See Cohen et al., The Small-Scale Structure of Radio Galaxies and Quasi-stellar Sources at 3.8 Centimeters, **170**, 207.
———. See Wade et al., Radio Emission from the Nucleus of NGC 5128, **170**, L11.
Kellermann, K. I., Davis, M. M., and Pauliny-Toth, I. I. K. Counts of Radio Sources at 6-Centimeter Wavelength, **170**, L1.
Kellermann, K. I., Jauncey, D. L., Cohen, M. H., Shaffer, B. B., Clark, B. G., Broderick, J., Rönnäng, B., Rydbeck, O. E. H., Matveyenko, L., Moiseyev, I., Vitkevitch, V. V., Cooper, B. F. C., and Batchelor, R. High-Resolution Observations of Compact Radio Sources at 6 and 18 Centimeters, **169**, 1.
Kellermann, K. I., and Pauliny-Toth, I. I. K. Radio Observations of the Infrared Object IRC 10216, **166**, L17.
Kellogg, E. See Giacconi et al., Discovery of Periodic X-Ray Pulsations in Centaurus X-3 from *Uhuru*, **167**, L67.
———. See Giacconi et al., An X-Ray Scan of the Galactic Plane from *Uhuru*, **165**, L27.
———. See Gursky et al., A Strong X-Ray Source in the Coma Cluster Observed by *Uhuru*, **167**, L81.
———. See Leong et al., X-Ray Emission from the Magellanic Clouds Observed by *Uhuru*, **170**, L67.
———. See Oda et al., X-Ray Pulsations from Cygnus X-1 Observed from *Uhuru*, **166**, L1.
———. See Schreier et al., Further Observations of the Pulsating X-Ray Source Cygnus X-1 from *Uhuru*, **170**, L21.
———. See Tananbaum et al., Measurement of the Location of the X-Ray Sources Cygnus X-1 and Cygnus X-2 from *Uhuru*, **165**, L37.
———. See Tananbaum et al., X-Ray Observations of GX 17+2 from *Uhuru*, **168**, L25.
Kellogg, E., Gursky, H., Leong, C., Schreier, E., Tananbaum, H., and Giacconi, R. X-Ray Observations of the Virgo Cluster, NGC 5128, and 3C 273 from the *Uhuru* Satellite, **165**, L49.
Kellogg, E., Gursky, H., Murray, S., Tananbaum, H., and Giacconi, R. X-Ray Sources near the Galactic Center Observed by *Uhuru*, **169**, L99.
Kellogg, E. M. See Gursky et al., Detection of X-Rays from the Seyfert Galaxies NGC 1275 and NGC 4151 by the *Uhuru* Satellite, **165**, L43.
Kemp, James C., Swedlund, John B., and Wolstencroft, Ramon D. Confirmation of the Magnetic White Dwarf G–195–19, **164**, L17.
Kemper, Edward. See Barker et al., Abundance Analyses of Population II Variable Stars. I. W Virginis, **165**, 67.
Kerr, F. J. See Gursky et al., The Estimated Distance to Cygnus X-1 Based on Its Low-Energy X-Ray Spectrum, **167**, L15.
———. See Jackson and Kerr, Detection of Radio Recombination-Line Emission Associated with Distributed Ionized Hydrogen, **168**, 29.
Kestenbaum, H. See Angel et al., Evidence of High-Frequency Oscillations in the X-Ray Flux from Scorpius X-1, **169**, L57.

XUM

Kestenbaum, H., Angel, J. R. P., and Novick, R. X-Ray Spectrum of Scorpius X-1 Obtained with a Bragg Crystal Spectrometer, **164**, L87.
Kestenbaum, H., Angel, J. R. P., Novick, R., and Cocke, W. J. Correlated Transient Short-Period Oscillation in the Optical and X-Ray Flux from Scorpius X-1, **169**, L49.
Khachikian, Edward Ye., and Weedman, Daniel W. A New Cloud of Hydrogen Emission in a Bright Galactic Nucleus, **164**, L109.
Khare, B. N. See Sagan and Khare, Experimental Jovian Photochemistry: Initial Results, **168**, 563.
King, Ivan R. See Spinrad et al., Maffei 1: A New Massive Member of the Local Group?, **163**, L25.
Kleinmann, D. E. See Becklin et al., Infrared Observations of the Core of Centaurus A, NGC 5128, **170**, L15.
Kleinmann, D. E., Lee, T., Low, F. J., and O'Dell, C. R. Infrared Observations of Comets 1969g and 1969i, **165**, 633.
Klimas, A. J., and Sandri, G. Foundation of the Theory of Cosmic-Ray Transport in Random Magnetic Fields, **169**, 41.
Klose, Jules Z. Mean Lives and Absolute *f*-Values in Neutral Iron, **165**, 637.
Knacke, R. F. See Cudaback et al., Silicon Monoxide in the Infrared Spectrum of Alpha Orionis, **166**, L49.
———. See Gillett et al., Infrared Studies of Galactic Nebulae. II. The Compact Nebulae IC 4997, VV 8, and FG Sagittae, **163**, L57.
Kniffen, D. A. See Fichtel et al., Results of Gamma-Ray Balloon Astronomy, **168**, 581.
Knight, C. A. See Johnston et al., An Interferometer Map of the Water-Vapor Sources in W49, **166**, L21.
Knowles, S. H. See Johnston et al., An Interferometer Map of the Water-Vapor Sources in W49, **166**, L21.
———. See Johnston et al., Observations of 1.35-Centimeter H_2O Emission in the Southern Hemisphere, **167**, L93.
Knowles, S. H., and Cheung, A. C. Further Investigations of NH_3 Inversion Radiation, **164**, L19.
Kochhar, R. K., and Trehan, S. K. The Oscillations and the Stability of Rotating Masses with Toroidal Magnetic Fields. II, **168**, 265.
Kollberg, Erik. See Seielstad et al., A Search for Redshifted Neutral Hydrogen in 3C 48 and Other Compact Objects, **170**, 219.
Koren, Marvin. See Tucker and Koren, Radiation from a High-Temperature, Low-Density Plasma: The X-Ray Spectrum of the Solar Corona, **168**, 283; Erratum, **170**, 621.
Kovach, William S. The Dynamics and Infrared Radiation of Young, Dust-filled Planetary Nebulae, **168**, 423.
Kovar, N. S. See Kovar et al., The Infrared Spectrum of IC 418, **170**, 449.
Kovar, R. P., Potter, A. E., Kovar, N. S., and Trafton, L. The Infrared Spectrum of IC 418, **170**, 449.
Kraft, Robert P. See Anderson and Kraft, Abundance Analyses of Population II Variable Stars. II. TW Capricorni, **167**, 119.
———. See Anderson and Kraft, Further Spectroscopic Observations of the Nucleus of the Seyfert Galaxy NGC 4151, **165**, L3.
———. See Barker et al., Abundance Analyses of Population II Variable Stars. I. W Virginis, **165**, 67.
Kraus, John D. See Boeshaar and Kraus, Ohio Radio Sources in Clusters of Galaxies, **165**, 445.
———. See Wills et al., Ohio Radio-Source Spectra: List II, **169**, L87.
Kraushaar, W. L. See Bunner et al., Low-Energy Diffuse X-Rays, **167**, L3.
———. See Coleman et al., X-Ray Observation of a New Soft Source in Cygnus, **170**, L47.
———. See McCammon et al., A Search for Absorption of the Soft X-Ray Diffuse Flux by the Small Magellanic Cloud, **168**, L33.
Krauss, M. See Julienne et al., Formation of OH through Inverse Predissociation, **170**, 65.
Kreplin, R. W. See Doschek et al., Heliumlike Calcium Emission Observed during a Solar Flare, **164**, 165.

———. See Doschek et al., Iron-Line Emission during Solar Flares, **170**, 573.
———. See Kahler and Kreplin, The Observation of Nonthermal Solar X-Radiation in the Energy Range $3 < E < 10$ keV, **168**, 531.
Kriese, J. T., and Siewert, C. E. An Expedient Method for Calculating H-Matrices, **164**, 389.
Krishna Swamy, K. S. Thermal Emission from Grains in the Galactic Center, **167**, 63.
Kristian, J., Brucato, R., Visvanathan, N., Lanning, H., and Sandage, A. On the Optical Identification of Cygnus X-1, **168**, L91.
Kristian, Jerome. See Greenstein et al., Spectra of White Dwarfs with Circular Polarization, **169**, L63.
Kuhi, Leonard V. See Spinrad et al., The Detection of the Galactic Nucleus at One Micron, **165**, 17.
Kulander, John L. The Velocity-dependent Non-LTE Source Function. II. Finite Layers, **165**, 543.
Kulsrud, Russell M. Rotational Deceleration of Magnetized Stars, **163**, 567.
Kundu, M. R. Polarization of the Supernova Remnant HB 21 at a Wavelength of 6 Centimeters, **165**, L55.
Kundu, M. R., and Velusamy, T. Polarization of Tycho's Supernova Remnant at a Wavelength of 2.8 Centimeters, **163**, 231.
Kunkel, William E., and Bradt, Hale V. Identification of the Nucleus of NGC 5128, **170**, L7.
Kunze, H.-J., and Datla, R. U. On the Oscillator Strengths of the $3s\ ^2S$-$4p\ ^2P$ and $3d\ ^2D$-$4p\ ^2P$ Transitions in Sodiumlike Ions, **169**, 425.
Kurfess, J. D. Observation of Low-Energy Gamma Radiation from NP 0532, **168**, L39.
Kutner, M. See Thaddeus et al., Discovery of Para-Formaldehyde and the 2-Millimeter Formaldehyde Distribution in the Orion Infrared Nebula, **168**, L59.
———. See Wilson et al., Discovery of Interstellar Silicon Monoxide, **167**, L97.
Kutner, M., and Thaddeus, P. 6-Centimeter Formaldehyde Absorption and Emission in the Orion Nebula, **168**, L67.
Kutner, M., Thaddeus, P., Jefferts, K. B., Penzias, A. A., and Wilson, R. W. Observation of 140-GHz Formaldehyde Line Emission from the Trapezium Region of the Orion Nebula, **164**, L49.
Kutter, G. S. Termination of Shell Burning of Helium in Solar-Mass Stars, **164**, 115.
Kuvshinov, V. M. See Nikulin et al., On the Circular Polarization of Some Peculiar Objects, **170**, L53.

Lampton, M., Bowyer, Stuart, Mack, J. E., and Margon, B. X-Ray Observations of Virgo XR-1, **168**, L1.
Lampton, Michael. See Margon et al., Evidence for a Highly Compact X-Ray Source, **169**, L45.
———. See Margon et al., A Pulsing X-Ray Source in Circinus, **169**, L23.
Lampton, Michael, Bowyer, Stuart, Welch, Jack, and Grasdalen, Gary. Simultaneous Radio and Optical Measurements of Scorpius XR-1, **164**, L61.
Landau, Robert. See Spinrad et al., Maffei 1: A New Massive Member of the Local Group?, **163**, L25.
Landstreet, J. D. See Angel and Landstreet, Detection of Circular Polarization in a Second White Dwarf, **164**, L15.
———. See Angel and Landstreet, Discovery of Periodic Variations in the Circular Polarization of the White Dwarf G195–19, **165**, L71.
Landstreet, J. D., and Angel, J. R. P. Discovery of Circular Polarization in the White Dwarf G99–37, **165**, L67.
Lang, Kenneth R. Interstellar Scintillation of Pulsar Radiation, **164**, 249.
Lanning, H. See Kristian et al., On the Optical Identification of Cygnus X-1, **168**, L91.
Larson, M. D. See Wallace et al., A Search for Deuterium on Venus, **168**, L29.
Lasker, Barry M., and Hesser, James E. High-Frequency Stellar Oscillations. V. Power Spectra for the Central Stars of Planetary Nebulae, **164**, 303.

XUM

Lasker, Barry M., and Hesser, James E. High-Frequency Stellar Oscillations. VI. R548, a Periodically Variable White Dwarf, **163**, L89.

Lawrence, George M. See Martinez-Garcia et al., Branching Ratios and Transition Probabilities in Fe I, **165**, 213.

Lazarus, Alan J., and Goldstein, Bruce E. Observation of the Angular-Momentum Flux Carried by the Solar Wind, **168**, 571.

Leacock, R. J. See Folsom et al., Optical Changes in Eleven Ohio Radio Sources with Unusual Spectra, **169**, L131.

Lee, Huan, Leung, Y. C., and Wang, C. G. Properties of Hadron Matter. I. The Equation of State, **166**, 387.

Lee, P. See Kaler et al., The Continuous Spectrum of Neutral Helium from Gaseous Nebulae, **163**, 141.

Lee, T. See Kleinmann et al., Infrared Observations of Comets 1969g and 1969i, **165**, 633.

Lenchek, Allen M. See Goldstein and Lenchek, The Theory of Inverse Compton Scattering in a Cold Plasma, **163**, 515.

Leong, C. See Gursky et al., Detection of X-Rays from the Seyfert Galaxies NGC 1275 and NGC 4151 by the *Uhuru* Satellite, **165**, L43.

———. See Gursky et al., A Strong X-Ray Source in the Coma Cluster Observed by *Uhuru*, **167**, L81.

———. See Kellogg et al., X-Ray Observations of the Virgo Cluster, NGC 5128, and 3C 273 from the *Uhuru* Satellite, **165**, L49.

Leong, C., Kellogg, E., Gursky, H., Tananbaum, H., and Giacconi, R. X-Ray Emission from the Magellanic Clouds Observed by *Uhuru*, **170**, L67.

Lerche, I. Gravitational Kinetic Equations, **166**, 207.

———. Kinematic-Dynamo Theory, **166**, 627.

———. Kinematic-Dynamo Theory. II. Dynamo Action in Infinite Media with Isotropic Turbulence, **166**, 639.

———. Kinematic-Dynamo Theory. III. The Effect of Turbulent Diffusivity in the Dynamo Equations, **168**, 115.

———. Kinematic-Dynamo Theory. IV. Dynamo Action in Nonrotating Spheres with Isotropic Turbulence, **168**, 123.

———. On the Origin of the Nonthermal Radio Emission at 0.4-6.5 MHz, **166**, 311.

Lerche, I., and Low, B.-C. Kinematic-Dynamo Action under Incompressible, Isotropic Velocity Turbulence, **168**, 503.

Lerche, I., and Parker, E. N. The Generation of Magnetic Fields in Astrophysical Bodies. VII. The Internal Small-Scale Fields, **168**, 231.

Leung, Y. C. See Lee et al., Properties of Hadron Matter. I. The Equation of State, **166**, 387.

Leung, Y. C., and Wang, C. G. Properties of Hadron Matter. II. Dense Baryon Matter and Neutron Stars, **170**, 499.

Levin, M. L., and Muratov, R. Z. On the Internal Potential of Heterogeneous Ellipsoids, **166**, 441.

Levy, Eugene H. The Dynamics of Hydromagnetic Bubbles and Double Radio Sources, **164**, 23.

Lewin, Walter H. G. See McClintock et al., Rapid Fluctuations in the High-Energy X-Ray Flux from a Source in Crux, **166**, L73.

Lewin, Walter H. G., McClintock, Jeffrey E., Ryckman, Stanley G., and Smith, William B. Detection of a High-Energy X-Ray Flare from a Source in Crux, **166**, L69.

Lewin, Walter H. G., Ricker, George R., and McClintock, Jeffrey E. X-Rays from a New Variable Source GX 1+4, **169**, L17.

Lezniak, J. A. See Baity et al., Intensities of Low-Energy Cosmic-Ray ^{2}H and ^{3}He Nuclei Measured in 1967-1968, **164**, 521.

Liebert, James. See Spinrad et al., The Detection of the Galactic Nucleus at One Micron, **165**, 17.

Liller, W. See Elliot et al., A Search for an Optical Source at the Position of Centaurus XR-3, **168**, L95.

Limber, D. Nelson. Asymmetries in the Envelopes of Wolf-Rayet Components of Close Binaries, **163**, 337.

Linnell, Albert P., and Proctor, Deanne D. A Computer Solution of the Light Curves of S Cancri, **164**, 131.
Litvak, M. M. The Meaning of the OH-H_2O Maser Maps, **170**, 71.
Lo, K. Y. See Johnston et al., An Interferometer Map of the Water-Vapor Sources in W49, **166**, L21.
Lockhart, Peggy. See Radhakrishnan et al., The Parkes Survey of 21-Centimeter Absorption in Discrete-Source Spectra. II. Galactic 21-Centimeter Observations in the Direction of 35 Extragalactic Sources, **170**, 617.
Lockwood, G. W., and Wing, Robert F. Light Curves of Mira Variables at 1.04 Microns, **169**, 63.
Loh, E. D., and Garmire, G. P. Radiative Transfer in an Ionized Medium at High Temperature, **166**, 301; Erratum, **169**, 447.
Loren, Robert B. See Wagner et al., Spectrophotometry of Nova Serpentis 1970, **165**, 431.
Lorre, Jean. See Barker et al., Abundance Analyses of Population II Variable Stars. I. W Virginis, **165**, 67.
Lovas, Frank. See Johnson and Lovas, A New Look at the Laboratory Microwave Spectrum of Cyanoacetylene, **169**, 617.
Low, B.-C. See Lerche and Low, Kinematic-Dynamo Action under Incompressible, Isotropic Velocity Turbulence, **168**, 503.
Low, F. J. See Harper and Low, Far-Infrared Emission from H II Regions, **165**, L9.
———. See Kleinmann et al., Infrared Observations of Comets 1969g and 1969i, **165**, 633.
———. See Neugebauer et al., Infrared Observations on the Size of NGC 1068, **166**, L45.
Lucy, L. B. The Formation of Resonance Lines in Extended and Expanding Atmospheres, **163**, 95.
Lutz, Barry L. The Emission Spectrum of CN^+, **163**, 131.
———. Spectrum of the CN Molecule. II. $F\,^2\Delta_r$-$A\,^2\Pi_i$, **164**, 213.
Lynds, R. See Mook et al., Spectroscopic Observations of Scorpius X-1, **163**, L69.
Lynds, Roger. The Absorption-Line Spectrum of 4C 05.34, **164**, L73.
———. On the Nature of the Galaxy Identified with 3C 386, **168**, L87.
Lyons, Peter B. See Toevs et al., Stellar Rates for the $^{28}Si(\alpha,\gamma)^{32}S$ and $^{16}O(\alpha,\gamma)^{20}Ne$ Reactions, **169**, 421.

McCammon, D. See Bunner et al., Low-Energy Diffuse X-Rays, **167**, L3.
———. See Coleman et al., X-Ray Observation of a New Soft Source in Cygnus, **170**, L47.
McCammon, D., Bunner, A. N., Coleman, P. L., and Kraushaar, W. L. A Search for Absorption of the Soft X-Ray Diffuse Flux by the Small Magellanic Cloud, **168**, L33.
McClintock, Jeffrey E. See Lewin et al., Detection of a High-Energy X-Ray Flare from a Source in Crux, **166**, L69.
———. See Lewin et al., X-Rays from a New Variable Source GX 1+4, **169**, L17.
McClintock, Jeffrey E., Ricker, George R., and Lewin, Walter H. G. Rapid Fluctuations in the High-Energy X-Ray Flux from a Source in Crux, **166**, L73.
McClure, Robert D. See Janes and McClure, Strong-Cyanogen Stars: Photometry and Kinematics, **165**, 561.
———. See Spinrad et al., Color Changes and Absorption-Line Variations over the Inner Disk of M31 and the Central Regions of M32 and NGC 4472, **164**, 11.
MacConnell, Darrell J. See Bond and MacConnell, The Nature of the Field Blue-Straggler Stars, **165**, 51.
McCord, Thomas B. See Johnson and McCord, Spectral Geometric Albedo of the Galilean Satellites, 0.3 to 2.5 Microns, **169**, 589.
———. See Pilcher and McCord, Narrow-Band Photometry of the Bands of Jupiter, **165**, 195.
McCord, Thomas B., Johnson, Torrence V., and Elias, Jonathan H. Saturn and Its Satellites: Narrow-Band Spectrophotometry (0.3-1.1 μ), **165**, 413.

XUM

McCord, Thomas B., and Westphal, James A. Mars: Narrow-Band Photometry, from 0.3 to 2.5 Microns, of Surface Regions during the 1969 Apparition, **168**, 141.

McCray, Richard. See Arons et al., Interaction of Fast Particles with Intergalactic Matter, **170**, 431.

Macdonald, G. H., and Miley, G. K. The Radio Structures of Seventy-nine Quasi-stellar Objects, **164**, 237.

McElroy, M. B. See Belton et al., The Atmosphere of Uranus, **164**, 191.

Mack, J. E. See Lampton et al., X-Ray Observations of Virgo XR-1, **168**, L1.

McKee, Christopher. See Quirk and McKee, The Stability of Supermassive Disks against Fragmentation, **169**, 119.

McKee, Christopher F. The Effect of Plasma Instabilities in Colgate's Cosmic-Ray Model, **166**, 573.

Malone, R. C. See Salpeter and Malone, Possible Recombination Lines from Molecular-Hydrogen Regions, **167**, 27.

Manchester, R. N. Observations of Pulsar Polarization at 410 and 1665 MHz, **168**, 173; Suppl., **23**, 283 (No. 199).

———. Observations of the Crab Pulsar at 410 and 1664 MHz, **163**, L61.

———. Properties of PSR 0525+21, **167**, L101.

———. See Huguenin et al., Properties of Pulsars, **169**, 97.

Manchester, R. N., and Gordon, M. A. Excitation Temperatures of the 18-Centimeter OH Transitions in an Absorbing Cloud, **169**, 507.

Mansfield, M. W. D. See Connerade et al., Absorption Spectrum of Na I in the Vacuum Ultraviolet, **165**, 203.

Maran, Stephen P. See Alexander et al., The Gum Nebula: Further Evidence from Spacecraft and Ground-based Instruments, **167**, 487.

———. See Brandt et al., The Gum Nebula: Fossil Strömgren Sphere of the Vela X Supernova, **163**, L99.

———. See Hobbs et al., Evidence for an Optically Thick Component in the Galactic Radio Source Sagittarius B_2, **165**, L87.

———. See Hudson et al., Automated and Conventional Photometry of the Short-Period Variable Star 14 Aurigae, **165**, 573.

Margolis, Jack S. Studies of Methane Absorption in the Jovian Atmosphere. III. The Reflecting-Layer Model, **167**, 553.

Margon, B. See Lampton et al., X-Ray Observations of Virgo XR-1, **168**, L1.

Margon, Bruce, Bowyer, Stuart, Lampton, Michael, and Cruddace, Ray. Evidence for a Highly Compact X-Ray Source, **169**, L45.

Margon, Bruce, Lampton, Michael, Bowyer, Stuart, and Cruddace, Ray. A Pulsing X-Ray Source in Circinus, **169**, L23.

Marionni, Paul. See Hobbs and Marionni, Search for 3.5-Millimeter Continuum Radiation from Infrared Stars and Related Objects, **167**, 85.

Mark, James W-K. Collective Instabilities and Waves for Inhomogeneous Stellar Systems. II. The Normal-Modes Problem of the Self-consistent Plane-parallel Slab, **169**, 455.

Marks, Dennis W., and Clement, Maurice J. On the Behavior of the Angular Velocity near the Surfaces of Stars with Radiative Envelopes, **166**, L27.

Marlborough, J. M. A Comparison of Theoretical and Observational Results for Pleione's Shell Episode, 1938-1954, **163**, 525.

———. Radiation Pressure and Accelerating Stellar Winds, **169**, 441.

Marlborough, J. M., and Roy, J.-Rene. Models for the Envelopes of Be Stars. III. Pole-on Stars, **169**, 327.

Martin, T. Z. See Morrison et al., Thermal Inertia of Ganymede from 20-Micron Eclipse Radiometry, **167**, L107.

Martinez-Garcia, Mario, Whaling, Ward, Mickey, Donald, L., and Lawrence, George M. Branching Ratios and Transition Probabilities in Fe I, **165**, 213.

Martonchik, John V. See Beer et al., Absorption by Venus in the 3-4-Micron Region, **168**, L121.

Mason, G. M. See Hsieh et al., Cosmic-Ray ^2H from Satellite Measurements, 1965 to 1969, **166**, 221.

Mather, John C., Werner, Michael W., and Richards, P. L. A Search for Spectral Features in the Submillimeter Background Radiation, **170**, L59.

Mathews, William G. The Hydromagnetic Free Expansion of a Relativistic Gas, **165**, 147.

Mathews, William G., and Baker, James C. Galactic Winds, **170**, 241.

Mathis, John S. Internal Dust in Gaseous Nebulae. II. Absorption of Lyman-Continuum Radiation by Dust, **167**, 261.

Mathur, K. C., Tripathi, A. N., and Joshi, S. K. Cross-Sections and Reaction Rates for Electron-Impact Ionization of Lithiumlike and Sodiumlike Positive Ions, **165**, 425.

Matsuoka, M. See Miyamoto et al., Measurement of the Location of the X-Ray Source Cygnus X-1, **168**, L11.

Matveyenko, L. See Kellermann et al., High-Resolution Observations of Compact Radio Sources at 6 and 18 Centimeters, **169**, 1.

Matzner, Richard A., and Nutku, Yavuz. On Stationary Axisymmetric Solutions of the Einstein Field Equations, **167**, 149.

Mayer, W. See Rappaport et al., GX 349+2 and GX 340+0: Locations and X-Ray Pulsation Limits, **169**, L93.

Meekins, J. F. See Doschek et al., Heliumlike Calcium Emission Observed during a Solar Flare, **164**, 165.

———. See Doschek et al., Iron-Line Emission during Solar Flares, **170**, 573.

Meekins, John F. See Fritz et al., Discovery of an X-Ray Source in Perseus, **164**, L81.

———. See Fritz et al., The X-Ray Spectra of the Crab Nebula and NP 0532, **164**, L55.

———. See Henry et al., Excess Background Radiation of Soft X-Rays at the Galactic Pole and Plane, **163**, L73.

———. See Shulman et al., Line Emission in the X-Ray Background, **166**, L9.

———. See Shulman et al., X-Ray Intensity Fluctuations in Cygnus XR-1, **168**, L49.

Meeks, M. L. See Ball et al., Search for the $^2\Pi_{1/2}$, J = 5/2 Excited State of OH in W3, **163**, L33.

Meidav, Meir. See Shulman et al., X-Ray Intensity Fluctuations in Cygnus XR-1, **168**, L49.

Mendoza V., Eugenio E. Photometric Observations of V1057 Cygni, **169**, L117.

Mengel, John G. See Demarque and Mengel, Advanced Evolution of Population II Stars. I. Red Giants and the Helium Flash, **164**, 317.

———. See Demarque and Mengel, Advanced Evolution of Population II Stars. II. The Horizontal Branch, **164**, 469.

———. See Demarque et al., The Early Evolution of Population II Stars. II, **163**, 37.

Merrill, K. M. See Gillett et al., Observations of Infrared Radiation from Cool Stars, **164**, 83.

Mickey, Donald L. See Martinez-Garcia et al., Branching Ratios and Transition Probabilities in Fe I, **165**, 213.

Middleditch, John. See Horowitz et al., Optical Time-of-Arrival Measurements from the Crab Pulsar: Comparison of Results from Four Observatories, **166**, L91.

Mihalas, Dimitri. A Comment on the Interpretation of the Broad Component of N III λλ4634-4640 Emission in Of Stars, **170**, 541.

Miley, G. K. See Macdonald and Miley, The Radio Structures of Seventy-nine Quasi-stellar Objects, **164**, 237.

———. See Wardle and Miley, Radio Emission from Quasi-stellar Objects, **164**, L119.

Miller, Joseph S. Photoelectric Measurements of High-n Balmer Lines in NGC 7027 and NGC 7662, **165**, L101.

Miller, R. H. Pair Correlations in Stellar Systems, **165**, 391.

Miller, Richard H. See Butterworth and Miller, Relaxation Time in Clusters with Pair Correlations, **170**, 275.

Miyamoto, S., Fujii, M., Matsuoka, M., Nishimura, J., Oda, M., Ogawara, Y., Ohta, S., and Wada, M. Measurement

XUM

of the Location of the X-Ray Source Cygnus X-1, **168**, L11.
Modali, Sarma B. See Hobbs et al., Evidence for an Optically Thick Component in the Galactic Radio Source Sagittarius B_2, **165**, L87.
Moffett, T. J., and Bopp, B. W. Discovery of Flare Activity on YY Geminorum, **168**, L117.
Moiseyev, I. See Kellermann et al., High-Resolution Observations of Compact Radio Sources at 6 and 18 Centimeters, **169**, 1.
Molnar, Michael R. The *r*-Process in a Hydrodynamical Model of the Helium Flash, **163**, 203.
Montgomery, John W., Epstein, Eugene E., Oliver, John P., Dworetsky, Michael M., and Fogarty, William G. M17 and Taurus A: 3.4-Millimeter Contour Maps and Integrated Fluxes, **167**, 77.
Montgomery, M. D. See Burlaga et al., Energy Transfer at Colliding Streams in the Solar Wind, **164**, 137.
Mook, D., Hiltner, W. A., and Lynds, R. Spectroscopic Observations of Scorpius X-1, **163**, L69.
Moos, H. W. See Rottman et al., Lyman-Alpha Emission from Arcturus, **165**, 661.
Moos, H. W., and Rottman, G. J. O I and H I Emissions from the Upper Atmosphere of Venus, **169**, L127.
Moran, J. M. See Johnston et al., An Interferometer Map of the Water-Vapor Sources in W49, **166**, L21.
Morgan, F. J. See Gabriel et al., Rocket Observations of the Ultraviolet Solar Spectrum during the Total Eclipse of 1970 March 7, **169**, 595.
Morgan, W. W. See Heeschen et al., The Distribution of Light in the Central Regions of Some Giant Elliptical Galaxies, **165**, L65.
Morris, M. See Zuckerman et al., New Ammonia Lines and Sources in the Galaxy, **169**, L105.
Morris, M., Zuckerman, B., Palmer, Patrick, and Turner, B. E. HCN in IRC+10216, **170**, L109.
Morrison, D., Cruikshank, D. P., Murphy, R. E., Martin, T. Z., Beery, J. G., and Shipley, J. P. Thermal Inertia of Ganymede from 20-Micron Eclipse Radiometry, **167**, L107.
Morrison, P. See Cavaliere et al., On Quasar Evolution, **170**, 223.
Morrison, Philip. See Kafatos and Morrison, Fossil Strömgren Spheres from Supernova Explosions, **168**, 195.
Moss, T. A., and Giuli, R. T. The Modulation of Galactic Protons by the Solar Wind: A Monte Carlo Approach, **167**, 331.
Mulholland, J. Derral. The System of Planetary Masses as Error Sources in Pulsar Timings, **165**, 105.
Mumford, George S. Binary Stars among Cataclysmic Variables. XII. Photoelectric Observations from the Southern Hemisphere, **165**, 369.
Muncaster, G. W. See Cocke et al., Upper Limit to Circular Polarization of Optical Pulsar NP 0532, **169**, L119.
Münch, G., and Persson, S. E. The Distribution of Gas and Dust in the Orion Nebula, **165**, 241.
Muratov, R. Z. See Levin and Muratov, On the Internal Potential of Heterogeneous Ellipsoids, **166**, 441.
Murdin, Paul. Effect upon Occultations of Lunar Surface Structure along the Line of Sight, **169**, 615.
———. See Duthie and Murdin, Accurate Timing of Light Flashes from the Pulsar in the Crab Nebula during the 1969-1970 Season, **163**, 1.
———. See Horowitz et al., Optical Time-of-Arrival Measurements from the Crab Pulsar: Comparison of Results from Four Observatories, **166**, L91.
Murphy, R. E. See Morrison et al., Thermal Inertia of Ganymede from 20-Micron Eclipse Radiometry, **167**, L107.
Murray, J. D. See Goss et al., The Parkes Survey of 21-Centimeter Absorption in Discrete-Source Spectra. IV. 21-Centimeter Absorption Measurements on Low-Latitude Sources South of Declination -46°, **170**, 617.
———. See Radhakrishnan et al., The Parkes Survey of 21-Centimeter Absorption in Discrete-Source Spectra. I. The

Parkes Hydrogen-Line Interferometer, **170**, 617.
———. See Radhakrishnan et al., The Parkes Survey of 21-Centimeter Absorption in Discrete-Source Spectra. II. Galactic 21-Centimeter Observations in the Direction of 35 Extragalactic Sources, **170**, 617.
———. See Radhakrishnan et al., The Parkes Survey of 21-Centimeter Absorption in Discrete-Source Spectra. III. 21-Centimeter Absorption Measurements on 41 Galactic Sources North of Declination −48°, **170**, 617.
Murray, S. See Gursky et al., A Strong X-Ray Source in the Coma Cluster Observed by *Uhuru*, **167**, L81.
———. See Kellogg et al., X-Ray Sources near the Galactic Center Observed by *Uhuru*, **169**, L99.
———. See Tananbaum et al., Measurement of the Location of the X-Ray Sources Cygnus X-1 and Cygnus X-2 from *Uhuru*, **165**, L37.
Mutschlecner, J. P. See Keller and Mutschlecner, Hydrodynamic Envelopes of Classical Cepheid Variables, **167**, 127.

Nagel, R. H. See Wallace et al., A Search for Deuterium on Venus, **168**, L29.
Nduka, A. The Roche Problem in an Eccentric Orbit, **170**, 131.
Nelson, Jerry. See Horowitz et al., Optical Time-of-Arrival Measurements from the Crab Pulsar: Comparison of Results from Four Observatories, **166**, L91.
Ness, Norman F. See Schatten and Ness, The Magnetic-Field Geometry of Jupiter and Its Relation to Io-Modulated Jovian Decametric Radio Emission, **165**, 621.
Nethery, C. M. See Fischel et al., On the Outer Layers of Model Moving Atmospheres, **163**, 649.
Neugebauer, G. See Becklin et al., Infrared Observations of the Core of Centaurus A, NGC 5128, **170**, L15.
Neugebauer, G., Garmire, G., Rieke, G. H., and Low, F. J. Infrared Observations on the Size of NGC 1068, **166**, L45.
Neugebauer, Gerry. See Spinrad et al., Maffei 1: A New Massive Member of the Local Group?, **163**, L25.
Newsom, G. H. Inner-Shell Absorption in the Spectra of the Alkaline Earths. I. Magnesium (Mg I), **166**, 243.
Ney, E. P. See Becklin et al., Infrared Observations of the Core of Centaurus A, NGC 5128, **170**, L15.
———. See Humphreys et al., High-Luminosity G Supergiants, **167**, L35.
Nicholls, R. W. See Gabriel et al., Rocket Observations of the Ultraviolet Solar Spectrum during the Total Eclipse of 1970 March 7, **169**, 595.
Nickerson, Bruce G., and Partridge, R. B. The Density of Intergalactic Dust: An Upper Limit, **169**, 203.
Nikulin, N. S., Kuvshinov, V. M., and Severny, A. B. On the Circular Polarization of Some Peculiar Objects, **170**, L53.
Nishimura, J. See Miyamoto et al., Measurement of the Location of the X-Ray Source Cygnus X-1, **168**, L11.
Noerdlinger, Peter D. Concerning a Proposed Test for the Expansion of Clusters of Galaxies, **163**, 437.
———. Models for the Stabilization of Clusters of Galaxies by Hot Gas Consistent with Observations of PKS 1116+12, **164**, 217.
———. See Colgate and Noerdlinger, Coherent Emission from Expanding Supernova Shells, **165**, 509.
Noerdlinger, Peter D., and Petrosian, Vahé. The Effect of Cosmological Expansion on Self-gravitating Ensembles of Particles, **168**, 1.
Nordsieck, Kenneth H. A Dust-Radiation Instability in Ionized Nebulae, **163**, 287.
———. A Further Comment on the Dust-Radiation Instability in Ionized Nebulae, **166**, 731.
Norris, John. Neutral-Helium Line Strengths. IV. Fourteen "Normal" Stars of Population I, **166**, 735; Suppl., **23**, 193 (No. 197).
———. Neutral-Helium Line Strengths. V. The Weak-Helium-Line Stars of Population I, **166**, 735; Suppl., **23**, 213 (No. 197).

XUM

Norris, John. Neutral-Helium Line Strengths. VI. The Variations of the Helium Spectrum Variable α Centauri, **166**, 735; Suppl., **23**, 235 (No. 197).
Norton, Robert H. See Beer et al., Absorption by Venus in the 3-4-Micron Region, **168**, L121.
Novick, R. See Angel et al., Evidence of High-Frequency Oscillations in the X-Ray Flux from Scorpius X-1, **169**, L57.
———. See Kestenbaum et al., Correlated Transient Short-Period Oscillation in the Optical and X-Ray Flux from Scorpius X-1, **169**, L49.
———. See Kestenbaum et al., X-Ray Spectrum of Scorpius X-1 Obtained with a Bragg Crystal Spectrometer, **164**, L87.
Nussbaumer, H. Forbidden Transitions in the C I Sequence, **166**, 411.
———. N III and C III Emission in Of Stars, **170**, 93.
Nutku, Yavuz. See Matzner and Nutku, On Stationary Axisymmetric Solutions of the Einstein Field Equations, **167**, 149.

O'Brien, John T. Transforms of the Hypergeometric Function that Allow for More Rapid Convergence in Calculations of Free-Free Gaunt Factors, **170**, 613.
Oda, M. See Miyamoto et al., Measurement of the Location of the X-Ray Source Cygnus X-1, **168**, L11.
Oda, M., Gorenstein, P., Gursky, H., Kellogg, E., Schreier, E., Tananbaum, H., and Giacconi, R. X-Ray Pulsations from Cygnus X-1 Observed from *Uhuru*, **166**, L1.
O'Dell, C. R. Nature of Particulate Matter in Comets as Determined from Infrared Observations, **166**, 675.
———. Spectrophotometry of Comet 1969g (Tago-Sato-Kosaka), **164**, 511.
———. See Kleinmann et al., Infrared Observations of Comets 1969g and 1969i, **165**, 633.
Ogawara, Y. See Miyamoto et al., Measurement of the Location of the X-Ray Source Cygnus X-1, **168**, L11.
Ögelman, H. B. See Fichtel et al., Results of Gamma-Ray Balloon Astronomy, **168**, 581.
Ogilvie, K. W. See Burlaga et al., Energy Transfer at Colliding Streams in the Solar Wind, **164**, 137.
Ohta, S. See Miyamoto et al., Measurement of the Location of the X-Ray Source Cygnus X-1, **168**, L11.
Oka, T., Shimizu, F. O., Shimizu, T., and Watson, J. K. G. Possible Rotational Equilibration of Interstellar Ammonia by Radiative $\Delta k = \pm 3$ Transitions, **165**, L15.
Oke, J. B. Redshifts and Absolute Spectral Energy Distributions of Galaxies in Distant Clusters, **170**, 193.
———. See Bahcall and Oke, Some Inferences from Spectrophotometry of Quasi-stellar Sources, **163**, 235.
———. See Greenstein et al., Effective Temperature, Radius, and Gravitational Redshift of Sirius B, **169**, 563.
———. See Schild and Oke, Energy Distributions and K-Corrections for the Total Light from Giant Elliptical Galaxies, **169**, 209.
———. See Schild et al., Effective Temperatures of B- and A-Type Stars, **166**, 95.
———. See Spinrad et al., Maffei 1: A New Massive Member of the Local Group?, **163**, L25.
Oliver, John P. See Montgomery et al., M17 and Taurus A: 3.4-Millimeter Contour Maps and Integrated Fluxes, **167**, 77.
Oster, Ludwig. Radio Emission from Stellar Coronas, **169**, 57.
Osterbrock, Donald E. Editorial, **169**, L1.
Ostriker, Jeremiah P. See Gunn and Ostriker, On the Motion and Radiation of Charged Particles in Strong Electromagnetic Waves. I. Motion in Plane and Spherical Waves, **165**, 523.
Ostriker, Jeremiah P., and Gunn, James E. Do Pulsars Make Supernovae?, **164**, L95.
Owen, Tobias. The 5520 Å Band of Ammonia in the Spectrum of Jupiter, **164**, 211.
Owens, A. J., and Jokipii, J. R. Cosmic-Ray Modulation by an Angle-dependent Solar Wind, **167**, 169.

Ozier, Irving. See Fox and Ozier, The Importance of Methane to Pressure-induced Absorption in the Atmospheres of the Outer Planets, **166**, L95.

Pacholczyk, A. G. Light Variations of the Seyfert Galaxy NGC 4151. III. Long-Term Photographic B-Variations and Infrared K-Data, **163**, 449.

Pacholczyk, A. G., and Swihart, T. L. Polarization of Radio Sources. III. Absorption Effects on Circular Polarization in a Synchrotron Source, **170**, 405.

Pacini, F. The Secular Decrease of Optical and X-Ray Luminosity of Pulsars, **163**, L17.

———. See Davidson et al., A Cocoon Pulsar Model for Scorpius X-1, **168**, 45.

Pacini, Franco. A Possible Interpretation of the Precursor Pulse in NP 0532, **169**, L11.

Palmer, Patrick. See Morris et al., HCN in IRC+10216, **170**, L109.

———. See Zuckerman et al., New Ammonia Lines and Sources in the Galaxy, **169**, L105.

Palmieri, T. M. See Seward et al., X-Rays from Puppis A and the Vicinity of Vela X, **169**, 515.

Palmieri, T. M., Burginyon, G. A., Grader, R. J., Hill, R. W., Seward, F. D., and Stoering, J. P. Diffuse Cosmic X-Ray Flux from 0.2 to 2 keV, **169**, 33.

———. Soft X-Rays from Two Supernova Remnants, **164**, 61.

Papa, D. C. See Johnston et al., An Interferometer Map of the Water-Vapor Sources in W49, **166**, L21.

Papadopoulos, G. D. See Johnston et al., An Interferometer Map of the Water-Vapor Sources in W49, **166**, L21.

Papagiannis, Michael D. See Strauss and Papagiannis, A Model for the Source of Solar-Flare X-Rays, **164**, 369.

Papaliolios, C. See Elliot et al., A Search for an Optical Source at the Position of Centaurus XR-3, **168**, L95.

———. See Horowitz et al., Results of a Search for Optical Pulsars, **163**, L5.

Papaliolios, Costas. See Horowitz et al., Optical Time-of-Arrival Measurements from the Crab Pulsar: Comparison of Results from Four Observatories, **166**, L91.

Parker, E. N. Generation of Magnetic Fields in Astrophysical Bodies. II. The Galactic Field, **163**, 255.

———. Generation of Magnetic Fields in Astrophysical Bodies. III. Turbulent Diffusion of Fields and Efficient Dynamos, **163**, 279.

———. The Generation of Magnetic Fields in Astrophysical Bodies. IV. The Solar and Terrestrial Dynamos, **164**, 491.

———. The Generation of Magnetic Fields in Astrophysical Bodies. V. Behavior at Large Dynamo Numbers, **165**, 139.

———. The Generation of Magnetic Fields in Astrophysical Bodies. VI. Periodic Modes of the Galactic Field, **166**, 295.

———. The Generation of Magnetic Fields in Astrophysical Bodies. VIII. Dynamical Considerations, **168**, 239.

———. See Lerche and Parker, The Generation of Magnetic Fields in Astrophysical Bodies. VII. The Internal Small-Scale Fields, **168**, 231.

Parkinson, W. J. See Gabriel et al., Rocket Observations of the Ultraviolet Solar Spectrum during the Total Eclipse of 1970 March 7, **169**, 595.

Parsons, Sidney B. Limb Darkening for Yellow Supergiants, **164**, 355.

Partridge, R. B. See Boughn et al., Isotropy of the Microwave Background at 8-Millimeter Wavelength, **165**, 439.

———. See Nickerson and Partridge, The Density of Intergalactic Dust: An Upper Limit, **169**, 203.

Partridge, R. Bruce. See Horowitz et al., Optical Time-of-Arrival Measurements from the Crab Pulsar: Comparison of Results from Four Observatories, **166**, L91.

Pasachoff, Jay M. The Calibration of the Wilson-Bappu Effect on the Sun, **164**, 385.

Pauliny-Toth, I. I. K. See Kellermann and Pauliny-Toth, Radio Observations of the Infrared Object IRC 10216, **166**, L17.

———. See Kellermann et al., Counts of Radio Sources at 6-Centimeter Wavelength, **170**, L1.

XUM

Paxton, H. J. B. See Gabriel et al., Rocket Observations of the Ultraviolet Solar Spectrum during the Total Eclipse of 1970 March 7, **169**, 595.
Pearce, J. A. See Hill et al., A Spectroscopic Study of Algol, **168**, 443.
Peery, Benjamin F., Jr. Technetium Stars, **163**, L1.
Peimbert, Manuel. On the Mass and Chemical Composition of Cassiopeia A, **170**, 261.
Peimbert, Manuel, and Bergh, Sidney van den. Optical Studies of Cassiopeia A. IV. Physical Conditions in the Gaseous Remnant, **167**, 223.
Peimbert, Manuel, and Torres-Peimbert, Silvia. Planetary Nebulae. III. Chemical Abundances, **168**, 413.
Penston, M. V. Identification of the Ryle-Neville Radio Sources, **170**, 395.
Penston, M. V., Allen, D. A., and Hyland, A. R. The Nature of Becklin's Star, **170**, L33.
Penzias, A. A. See Jefferts et al., Detection of Interstellar Carbonyl Sulfide, **168**, L111.
———. See Kutner et al., Observation of 140-GHz Formaldehyde Line Emission from the Trapezium Region of the Orion Nebula, **164**, L49.
———. See Solomon et al., Detection of Millimeter Emission Lines from Interstellar Methyl Cyanide, **168**, L107.
———. See Thaddeus et al., Discovery of Para-Formaldehyde and the 2-Millimeter Formaldehyde Distribution in the Orion Infrared Nebula, **168**, L59.
———. See Wilson et al., Discovery of Interstellar Silicon Monoxide, **167**, L97.
———. See Wilson et al., Millimeter Observations of CO, CN, and CS Emission from IRC+10216, **169**, L35.
———. See Woolf et al., Origin of the Reported Millimeter Continuum in IRC+10216, **167**, L65.
———. See Wrixon et al., Absolute Measurements of the Flux of Cassiopeia A and Taurus A at 1.87 Centimeters, **165**, 23.
Penzias, A. A., Jefferts, K. B., and Wilson, R. W. Interstellar $^{12}C^{16}O$, $^{13}C^{16}O$, and $^{12}C^{18}O$, **165**, 229.
Penzias, A. A., Solomon, P. M., Wilson, R. W., and Jefferts, K. B. Interstellar Carbon Monosulfide, **168**, L53.
Penzias, Arno A. See Solomon et al., Observation of CO Emission at 2.6 Millimeters from IRC+10216, **163**, L53.
Perkins, Francis. See Axel and Perkins, Mass Accretion and Pulsational Stability, **163**, 29.
Persides, S. The Gravitational Field of a Bounded Source in General Relativity, **170**, 479.
Persson, S. E. See Münch and Persson, The Distribution of Gas and Dust in the Orion Nebula, **165**, 241.
Peters, Geraldine J. Observation of Periodic Shell Activity by HR 2142, **163**, L107.
Peterson, Deane M., and Scholz, M. Investigation of Six O-Type Spectra, **163**, 51.
Peterson, D. M. See Schild et al., Effective Temperatures of B- and A-Type Stars, **166**, 95.
Pethick, Christopher. See Baym et al., The Ground State of Matter at High Densities: Equation of State and Stellar Models, **170**, 299.
Petrosian, Vahé. See Noerdlinger and Petrosian, The Effect of Cosmological Expansion on Self-gravitating Ensembles of Particles, **168**, 1.
Phillips, John G. Satellite Bands of the γ'-System of Titanium Oxide, **169**, 185.
Phillips, John G., and Davis, Sumner P. A New $^1\Sigma$-$^1\Sigma$ Transition of the TiO Molecule, **167**, 209.
Pilcher, Carl B., and McCord, Thomas B. Narrow-Band Photometry of the Bands of Jupiter, **165**, 195.
Pipher, Judith L. See Houck et al., Rocket-Infrared Four-Color Photometry of the Galaxy's Central Regions, **169**, L31.
Plass, Gilbert N. See Kattawar et al., Flux and Polarization Calculations of the Radiation Reflected from the Clouds of Venus, **170**, 371.
Pollack, J. B., Guthrie, P. D., and Shen, B.

S. P. On the Absorption of Gamma Rays by Photons in Pulsars, Quasi-stellar Objects, and Other Source Objects, **169**, L113.

Popper, Daniel M. Six Main-Sequence Eclipsing Binaries of Types A to F, **166**, 361.

———. Some Double-lined Eclipsing Binaries with Metallic-Line Spectra, **169**, 549.

Potter, A. E. See Kovar et al., The Infrared Spectrum of IC 418, **170**, 449.

Predmore, C. R., Goldwire, H. C., Jr., and Walters, G. K. Limiting ^{3}He Abundances in Four H II Regions, **168**, L125.

Press, William H. Long Wave Trains of Gravitational Waves from a Vibrating Black Hole, **170**, L105.

Preston, George W. The Isotope Structure of the Hg II Line λ3984 in the Spectrum of Iota Coronae Borealis, **164**, L41.

———. The Mean Surface Fields of Magnetic Stars, **164**, 309.

Price, M. J. See Belton et al., The Atmosphere of Uranus, **164**, 191.

Price, R. See Toor et al., X-Ray Source Positions for Cygnus X-1, Cygnus X-2, and Cygnus X-3, **168**, L15.

Price, R. E., Groves, D. J., Rodrigues, R. M., Seward, F. D., Swift, C. D., and Toor, A. X-Rays from the Magellanic Clouds, **168**, L7.

Proctor, Deanne D. See Linnell and Proctor, A Computer Solution of the Light Curves of S Cancri, **164**, 131.

Purcell, Edward M., and Spitzer, Lyman, Jr. Orientation of Rotating Grains, **167**, 31.

Purcell, G. H. See Cohen et al., The Small-Scale Structure of Radio Galaxies and Quasi-stellar Sources at 3.8 Centimeters, **170**, 207.

Quirk, William J. Numerical Experiments in Spiral Structure. II, **167**, 7.

Quirk, William J., and McKee, Christopher F. The Stability of Supermassive Disks against Fragmentation, **169**, 119.

Racine, René. Photometry of M67 to $M_V = +12$, **168**, 393.

Radford, H. E. See Ball et al., Search for Extraterrestrial $H_2{}^{18}O$ Emission, **163**, 429.

———. See Ball et al., Search for the $^2\Pi_{1/2}$, $J = 5/2$ Excited State of OH in W3, **163**, L33.

Radhakrishnan, V. See Goss et al., The Parkes Survey of 21-Centimeter Absorption in Discrete-Source Spectra. IV. 21-Centimeter Absorption Measurements on Low-Latitude Sources South of Declination −46°, **170**, 617.

Radhakrishnan, V., Brooks, J. W., Goss, W. M., Murray, J. D., and Schwarz, U. J. The Parkes Survey of 21-Centimeter Absorption in Discrete-Source Spectra. I. The Parkes Hydrogen-Line Interferometer, **170**, 617.

Radhakrishnan, V., and Goss, W. M. The Parkes Survey of 21-Centimeter Absorption in Discrete-Source Spectra. V. Note on the Statistics of Absorbing H I Concentrations in the Galactic Disk, **170**, 617.

Radhakrishnan, V., Goss, W. M., Murray, J. D., and Brooks, J. W. The Parkes Survey of 21-Centimeter Absorption in Discrete-Source Spectra. III. 21-Centimeter Absorption Measurements on 41 Galactic Sources North of Declination −48°, **170**, 617.

Radhakrishnan, V., Murray, J. D., Lockhart, Peggy, and Whittle, R. P. J. The Parkes Survey of 21-Centimeter Absorption in Discrete-Source Spectra. II. Galactic 21-Centimeter Observations in the Direction of 35 Extragalactic Sources, **170**, 617.

Ramaty, R., Boldt, E. A., Colgate, S. A., and Silk, J. Ionization and Heating of the Gum Nebula by Energetic Particles from the Vela X Supernova, **169**, 87.

Rank, D. M. See Holtz et al., Infrared Line Emission from Planetary Nebulae, **164**, L29.

Rankin, J. M. See Counselman and Rankin, Multipath Delay Distortion of Radio Pulses from NP 0532, **166**, 513.

Rankin, J. M., Heiles, Carl, and Comella, J. M. Pulsar NP 0532: Disappearance of the Precursor Pulse at 606 MHz, **163**, L95.

XUM

Rao, N. Kameswara. See Barker et al., Abundance Analyses of Population II Variable Stars. I. W Virginis, **165**, 67.
Rappaport, S., Doxsey, R., and Zaumen, W. A Search for X-Ray Pulsations from Cygnus X-1, **168**, L43.
Rappaport, S., Zaumen, W., and Doxsey, R. On the Location of Cygnus X-1, **168**, L17.
Rappaport, S., Zaumen, W., Doxsey, R., and Mayer, W. GX 349+2 and GX 340+0: Locations and X-Ray Pulsation Limits, **169**, L93.
Rasband, S. N. Expansion Anisotropy and the Spectrum of the Cosmic Background Radiation, **170**, 1.
Rayburn, D. R. See Chau et al., Evolution of a Stabilized Oblique Rotator: Behavior over Short and Long Time Scales, **168**, L79.
Reagan, Glenn H. See Barker et al., Abundance Analyses of Population II Variable Stars. I. W Virginis, **165**, 67.
Rees, D. E. See Cannon and Rees, Line Transfer in the Presence of Two-dimensional Velocity Gradients, **169**, 157.
Rees, Martin J. See Trimble and Rees, Runaway Stars and the Pulsars near the Crab Nebula (?), **166**, L85.
Reeves, E. M. See Dupree and Reeves, The Extreme-Ultraviolet Spectrum of the Quiet Sun, **165**, 599.
———. See Gabriel et al., Rocket Observations of the Ultraviolet Solar Spectrum during the Total Eclipse of 1970 March 7, **169**, 595.
Reichley, P. E. See Downs and Reichley, Observations of Interstellar Scintillations of Pulsar Signals at 2388 MHz, **163**, L11.
Reid, R. H. G. See Wofsy et al., Spin-Change Scattering of C II and O I by Atomic Hydrogen, **168**, 161.
Rhoades, Clifford E., Jr., and Ruffini, Remo. Hagedorn Equation of State in Neutron Stars, **163**, L83.
Ribes, J. C. See Gardner et al., Observations of the $^2\Pi_{1/2}$, J = 1/2 Line of OH at 4660 MHz in Sagittarius B2, **169**, L109.
Richards, P. L. See Mather et al., A Search for Spectral Features in the Submillimeter Background Radiation, **170**, L59.
Richer, Harvey B. Some Intrinsic Properties of Carbon Stars, **167**, 521.
Ricker, George R. See Lewin et al., X-Rays from a New Variable Source GX 1+4, **169**, L17.
———. See McClintock et al., Rapid Fluctuations in the High-Energy X-Ray Flux from a Source in Crux, **166**, L73.
Riegel, Kurt W. H I Spectral-Line Observations in the Direction of W31, **164**, 29.
Rieke, G. H. See Neugebauer et al., Infrared Observations on the Size of NGC 1068, **166**, L45.
Robbins, R. R., Daltabuit, E., and Cox, D. P. Reduced Helium Abundances in Nebulae, **169**, L77.
Robbins, R. R., and Robinson, E. L. Capture-Cascade Intensities of the Helium Singlets in Nebulae, **167**, 249.
Roberts, Morton S. See Burns and Roberts, The Neutral-Hydrogen Distribution and Rotation Parameters of the Spiral Galaxy NGC 2403, **166**, 265.
Roberts, M. S. See Gordon and Roberts, The Absence of Formaldehyde Radiation toward Cold Regions of the Galactic Plane, **170**, 277.
Roberts, P. H. See Durney and Roberts, On the Theory of Stellar Winds, **170**, 319.
Robertson, J. W. 5 $M_\odot$ Evolution for Population I Compositions, **170**, 353.
———. On Loop Sizes in the Hertzsprung-Russell Diagram during Core Helium Burning, **164**, L105.
Robinson, E. L. See Robbins and Robinson, Capture-Cascade Intensities of the Helium Singlets in Nebulae, **167**, 249.
Rodgers, A. W. The Reddening of Eta Carinae, **165**, 665.
———. Solar-Composition A Stars in the Galactic Halo, **165**, 581.
Rodrigues, R. M. See Price et al., X-Rays from the Magellanic Clouds, **168**, L7.
Roesler, F. L. See Traub and Roesler, The Abundance of Lithium in Sunspots, **163**, 629.
Rönnäng, B. See Kellermann et al., High-Resolution Observations of Com-

pact Radio Sources at 6 and 18 Centimeters, **169**, 1.

Rood, Herbert J. See Chincarini and Rood, Dynamics of the Perseus Cluster of Galaxies, **168**, 321.

———. See Chincarini et al., A Supermassive Double Galaxy in the Cluster Abell 1775, **169**, 11.

———. See Sastry and Rood, Rectangular Coordinates of Rich Clusters of Galaxies on the *Palomar Sky Survey* Charts, **169**, 445; Suppl., **23**, 371 (No. 201).

Rood, Herbert J., and Welch, Gary A. On the Origin of the Galactic Halo, **165**, 225.

Rood, Robert T. On the Use of Linear Interpolation in Opacity Tables, **169**, 191.

Rose, William K. See Thompson et al., Evidence for Hydrogen-to-Carbon Ratios in Accordance with the CNO Bi-Cycle in Several Carbon Stars, **163**, 533.

Rosendhal, Jeffrey D., and Snowden, Michael S. A Search for Light Variations in Some Supergiants in the Large Magellanic Cloud, **169**, 281.

Rottman, G. J. See Moos and Rottman, O I and H I Emissions from the Upper Atmosphere of Venus, **169**, L127.

Rottman, G. J., Moos, H. W., Barry, J. R., and Henry, R. C. Lyman-Alpha Emission from Arcturus, **165**, 661.

Roy, J.-Rene. See Marlborough and Roy, Models for the Envelopes of Be Stars. III. Pole-on Stars, **169**, 327.

Rubin, R. H. See Turner and Rubin, New Galactic H_2O Sources Associated with H II Regions, **170**, L113.

Rubin, R. H., Swenson, G. W., Jr., Benson, R. C., Tigelaar, H. L., and Flygare, W. H. Microwave Detection of Interstellar Formamide, **169**, L39.

Rubin, Robert H. See Johnson and Rubin, Observation and Classification of the Nebula YM 29, **163**, 151.

Rubin, Robert H., and Turner, Barry E. Observations of Compact H II Regions with Optical Counterparts, **165**, 471.

Rubin, Vera C., and Ford, W. Kent, Jr. Radial Velocities and Line Strengths of Emission Lines across the Nuclear Disk of M31, **170**, 25.

Ruderman, M. A., and Spiegel, E. A. Galactic Wakes, **165**, 1.

Ruffini, Remo. See Rhoades and Ruffini, Hagedorn Equation of State in Neutron Stars, **163**, L83.

Rugge, H. R. See Walker and Rugge, Observation of Autoionizing States in the Solar Corona, **164**, 181.

Ryckman, Stanley G. See Lewin et al., Detection of a High-Energy X-Ray Flare from a Source in Crux, **166**, L69.

Rydbeck, O. E. H. See Kellermann et al., High-Resolution Observations of Compact Radio Sources at 6 and 18 Centimeters, **169**, 1.

Saari, Donald G. Implications of the Inverse-Square-Law Model, **165**, 399.

Sagan, Carl, and Khare, B. N. Experimental Jovian Photochemistry: Initial Results, **168**, 563.

Salpeter, Edwin E. See Shaviv and Salpeter, Solar-Neutrino Flux and Stellar Evolution with Mixing, **165**, 171.

Salpeter, Edwin E., and Wagoner, Robert V. Structure of Relativistic Disks, **164**, 557.

Salpeter, E. E. See Davidson et al., A Cocoon Pulsar Model for Scorpius X-1, **168**, 45.

———. See Hollenbach and Salpeter, Surface Recombination of Hydrogen Molecules, **163**, 155.

———. See Hollenbach et al., Molecular Hydrogen in H I Regions, **163**, 165.

Salpeter, E. E., and Malone, R. C. Possible Recombination Lines from Molecular-Hydrogen Regions, **167**, 27.

Sampson, Douglas H. See Golden and Sampson, Electron-Impact Cross-Sections and Rates for $nl \rightarrow n'l'$ Transitions in Hydrogenic Ions and Hydrogen, **170**, 181.

———. See Golden and Sampson, Semiempirical Cross-Sections and Rates for Excitation and Ionization of Hydrogen by Electron Impact, **163**, 405.

Sampson, Douglas H., and Golden, Lawrence B. Semiempirical Cross-Sections

and Rates for Excitation and for Ionization of Hydrogenic Ions by Electron Impact, **170**, 169.

Sandage, A. See Kristian et al., On the Optical Identification of Cygnus X-1, **168**, L91.

Sandage, Allan. The Distance of the Local-Group Galaxy IC 1613 Obtained from Baade's Work on Its Stellar Content, **166**, 13.

Sandage, Allan, and Tammann, G. A. Absolute Magnitudes of Cepheids. III. Amplitude as a Function of Position in the Instability Strip: A Period-Luminosity-Amplitude Relation, **167**, 293; Erratum, **170**, 191.

Sanders, Robert H., and Balamore, Dilip S. Dust Scattering in the Filaments of M82, **166**, 7.

Sanderson, A. D. See Jackson et al., Stellar Rotation: A Comparison of Recent Results, **165**, 223.

Sandlin, G. D. See Widing et al., On the Classification of Some Highly Ionized Iron and Nickel Lines in the 200-400 Å Region of the Solar Spectrum, **169**, 405.

Sandri, G. See Klimas and Sandri, Foundation of the Theory of Cosmic-Ray Transport in Random Magnetic Fields, **169**, 41.

Sanduleak, N. On Stars Having Strong O VI Emission, **164**, L71.

Sargent, W. L. W. See Spinrad et al., Maffei 1: A New Massive Member of the Local Group?, **163**, L25.

Saslaw, William C. Differences in Stellar Content of the Nuclei of Galaxies with Measured Rotation Curves, **163**, 249.

———. See Field and Saslaw, Groups of Galaxies: Hidden Mass or Quick Disintegration?, **170**, 199.

Saslaw, William C., and De Young, David S. On Equipartition in Galactic Nuclei and Gravitating Systems, **170**, 423.

Sastry, G. N. See Welch and Sastry, Photographic Detection of "Intergalactic" Matter in the Coma Cluster, **169**, L3.

Sastry, Gummuluru N. See Chincarini et al., A Supermassive Double Galaxy in the Cluster Abell 1755, **169**, 11.

Sastry, Gummuluru N., and Rood, Herbert J. Rectangular Coordinates of Rich Clusters of Galaxies on the *Palomar Sky Survey* Charts, **169**, 445; Suppl., **23**, 371 (No. 201).

Savage, Howard F. See Boitnott and Savage, Light Emission Measurements of Calcium and Magnesium at Simulated Meteor Conditions. II. Spectral Luminous Efficiencies, **167**, 349.

Savage, Howard F., and Boitnott, Charles A. Light Emission Measurements of Calcium and Magnesium at Simulated Meteor Conditions. I. Cross-Section Measurements, **167**, 341.

Schaefer, A. R. Measured Lifetimes of Excited States of Magnesium, **163**, 411.

Schaefer, Henry F., III. See Heil and Schaefer, Four New Bound, Low-Lying States of Cyanogen: $^4\Sigma^+$, $^4\Sigma^-$, $^4\Pi$, $^4\Delta$, **163**, 425.

Schatten, Kenneth H., and Ness, Norman F. The Magnetic-Field Geometry of Jupiter and Its Relation to Io-modulated Jovian Decametric Radio Emission, **165**, 621.

Schild, R., and Oke, J. B. Energy Distributions and K-Corrections for the Total Light from Giant Elliptical Galaxies, **169**, 209.

Schild, R., Peterson, D. M., and Oke, J. B. Effective Temperatures of B- and A-Type Stars, **166**, 95.

Schild, Rudolph E., and Chaffee, Frederic. Energy Distributions and Spectra of Orion B Stars, **169**, 529.

Schlesinger, Barry M. Mass Functions of Clusters and the Distribution of Stars in the Color-Magnitude Diagram, **166**, 447.

Schmidt, Edward G. An Analysis of the Iron Spectrum of Four Cepheids, **170**, 109.

Schmidt, E. G. A Photometric Study of Four Classical Cepheids, **165**, 335.

Schmidtke, G. See Schweizer and Schmidtke, High-Resolution Extreme-Ultraviolet Solar Spectrum Recorded with a Diffraction-Filter Spectrograph, **169**, L27.

Schmitt, John L. Stars with Strong Cyanogen Absorption, **163**, 75.

Schnopper, Herbert W. See Thompson et al., Evidence for Hydrogen-to-Carbon Ratios in Accordance with the CNO Bi-Cycle in Several Carbon Stars, **163**, 533.

Scholz, M. See Peterson and Scholz, Investigation of Six O-Type Spectra, **163**, 51.

Schreier, E. See Giacconi et al., Discovery of Periodic X-Ray Pulsations in Centaurus X-3 from *Uhuru*, **167**, L67.

———. See Kellogg et al., X-Ray Observations of the Virgo Cluster, NGC 5128, and 3C 273 from the *Uhuru* Satellite, **165**, L49.

———. See Oda et al., X-Ray Pulsations from Cygnus X-1 Observed from *Uhuru*, **166**, L1.

———. See Tananbaum et al., Measurement of the Location of the X-Ray Sources Cygnus X-1 and Cygnus X-2 from *Uhuru*, **165**, L37.

Schreier, E., Gursky, H., Kellogg, E., Tananbaum, H., and Giacconi, R. Further Observations of the Pulsating X-Ray Source Cygnus X-1 from *Uhuru*, **170**, L21.

Schwartz, D. A. See Holt et al., Evidence for Multiple Periodicity in the X-Ray Emission from Cygnus X-1, **166**, L65.

Schwartz, P. R. See Barrett et al., Detection of Methyl Alcohol in Orion at a Wavelength of ~1 Centimeter, **168**, L101.

———. See Johnston et al., An Interferometer Map of the Water-Vapor Sources in W49, **166**, L21.

Schwarz, U. J. See Radhakrishnan et al., The Parkes Survey of 21-Centimeter Absorption in Discrete-Source Spectra. I. The Parkes Hydrogen-Line Interferometer, **170**, 617.

Schweizer, Francois. See Spinrad et al., The Detection of the Galactic Nucleus at One Micron, **165**, 17.

Schweizer, W., and Schmidtke, G. High-Resolution Extreme-Ultraviolet Solar Spectrum Recorded with a Diffraction-Filter Spectrograph, **169**, L27.

Scudder, J. See Toor et al., X-Ray Source Positions for Cygnus X-1, Cygnus X-2, and Cygnus X-3, **168**, L15.

Searle, Leonard. Evidence for Composition Gradients across the Disks of Spiral Galaxies, **168**, 327.

———. The Reddening of Cassiopeia A, **168**, 41.

Seielstad, G. A. See Weiler and Seielstad, Synthesis of the Polarization Properties of 3C 10 and 3C 58 at 1420 and 2880 MHz, **163**, 455.

Seielstad, G. A., Höglund, Bertil, and Kollberg, Erik. A Search for Redshifted Neutral Hydrogen in 3C 48 and Other Compact Objects, **170**, 219.

Serlemitsos, P. J. See Boldt et al., A Limit on Line Emission in the X-Ray Background at High Galactic Latitudes, **167**, L1.

———. See Boldt et al., Search for Temporal Structure in X-Rays from Scorpius X-1, **164**, L9.

———. See Holt et al., Evidence for Multiple Periodicity in the X-Ray Emission from Cygnus X-1, **166**, L65.

Severny, A. B. See Nikulin et al., On the Circular Polarization of Some Peculiar Objects, **170**, L53.

Seward, F. See Toor et al., X-Ray Source Positions for Cygnus X-1, Cygnus X-2, and Cygnus X-3, **168**, L15.

Seward, F. D. See Palmieri et al., Diffuse Cosmic X-Ray Flux from 0.2 to 2 keV, **169**, 33.

———. See Palmieri et al., Soft X-Rays from Two Supernova Remnants, **164**, 61.

———. See Price et al., X-Rays from the Magellanic Clouds, **168**, L7.

Seward, F. D., Burginyon, G. A., Grader, R. J., Hill, R. W., Palmieri, T. M., and Stoering, J. P. X-Rays from Puppis A and the Vicinity of Vela X, **169**, 515.

Shaffer, D. B. See Cohen et al., The Small-Scale Structure of Radio Galaxies and Quasi-stellar Sources at 3.8 Centimeters, **170**, 207.

———. See Kellermann et al., High-Resolution Observations of Compact Radio Sources at 6 and 18 Centimeters, **169**, 1.

Shane, K. C. See Couch and Shane, The Photodisintegration Rate of ^{24}Mg, **169**, 413.

Shapiro, I. I. See Johnston et al., An

Interferometer Map of the Water-Vapor Sources in W49, **166**, L21.
Shapiro, Stuart L. See Silk and Shapiro, Primordial Variations in the Cosmic Abundance of Helium, **166**, 249.
Shaviv, Giora, and Salpeter, Edwin E. Solar-Neutrino Flux and Stellar Evolution with Mixing, **165**, 171.
Shawl, S. J. See Dyck et al., Visual Intrinsic Polarization and Infrared Excess of Cool Stars, **165**, 57.
Shen, B. S. P. See Pollack et al., On the Absorption of Gamma Rays by Photons in Pulsars, Quasi-stellar Objects, and Other Source Objects, **169**, L113.
———. See Usher et al., I Zw 1: A Variable Compact Galaxy, **165**, 647.
Shenton, C. B. See Gabriel et al., Rocket Observations of the Ultraviolet Solar Spectrum during the Total Eclipse of 1970 March 7, **169**, 595.
Shimabukuro, F. I. See Simon and Shimabukuro, Observations of the Solar Oscillatory Component at a Wavelength of 3 Millimeters, **168**, 525.
Shimizu, F. O. See Oka et al., Possible Rotational Equilibration of Interstellar Ammonia by Radiative $\Delta k = \pm 3$ Transitions, **165**, L15.
Shimizu, T. See Oka et al., Possible Rotational Equilibration of Interstellar Ammonia by Radiative $\Delta k = \pm 3$ Transitions, **165**, L15.
Shipley, J. P. See Morrison et al., Thermal Inertia of Ganymede from 20-Micron Eclipse Radiometry, **167**, L107.
Shipman, H. L. Hydrogen-Rich Models for Horizontal-Branch and Post-Horizontal-Branch Stars, **166**, 587.
———. Polarization of Grw+70°8247: The Transfer Problem, **167**, 165.
———. See Greenstein et al., Effective Temperature, Radius, and Gravitational Redshift of Sirius B, **169**, 563.
Shostak, G. S., and Weliachew, L. Hydrogen Line and Continuum Study of Maffei 2 by Radio Interferometry, **169**, L71.
Shu, Frank H., Stachnik, Robert V., and Yost, Jonathan C. On the Density-Wave Theory of Galactic Spirals. III. Comparisons with External Galaxies, **166**, 465.
Shukla, P. G., and Wilson, B. G. Low-Energy Cosmic X-Rays, **164**, 265; Erratum, **168**, 319.
Shulman, Seth, Fritz, Gilbert, Meekins, John F., Chubb, T. A., Friedman, H., and Henry, Richard C. Line Emission in the X-Ray Background, **166**, L9.
Shulman, Seth, Fritz, Gilbert, Meekins, John F., Friedman, H., and Meidav, Meir. X-Ray Intensity Fluctuations in Cygnus XR-1, **168**, L49.
Siewert, C. E. See Bond and Siewert, On the Nonconservative Equation of Transfer for a Combination of Rayleigh and Isotropic Scattering, **164**, 97.
———. See Kriese and Siewert, An Expedient Method for Calculating H-Matrices, **164**, 389.
Silk, J. See Ramaty et al., Ionization and Heating of the Gum Nebula by Energetic Particles from the Vela X Supernova, **169**, 87.
Silk, Joseph. The Signature of a Pulsar on the Diffuse X-Ray Background, **166**, L39.
———. See Arons et al., Interaction of Fast Particles with Intergalactic Matter, **170**, 431.
———. See Wallerstein and Silk, Interstellar Gas in the Direction of the Vela Pulsar, **170**, 289.
Silk, Joseph, and Brown, Robert L. On the Ultraviolet Absorption-Line Spectra Produced by H I Regions, **163**, 495.
Silk, Joseph, and Shapiro, Stuart L. Primordial Variations in the Cosmic Abundance of Helium, **166**, 249.
Simon, M., and Shimabukuro, F. I. Observations of the Solar Oscillatory Component at a Wavelength of 3 Millimeters, **168**, 525.
Simon, Norman R. Second-Order Pulsations in Polytropes, **164**, 331.
Simpson, Erik E. Evolutionary Models of Stars of 15 and 30 $M_\odot$, **165**, 295.
Simpson, J. A. See Hsieh et al., Cosmic-Ray ^{2}H from Satellite Measurements, 1965 to 1969, **166**, 221.
Sinclair, M. W. See Gardner et al., Observations of the $^2\Pi_{1/2}$, $J = 1/2$

Line of OH at 4660 MHz in Sagittarius B2, **169**, L109.
Skilling, John. Cosmic Rays in the Galaxy: Convection or Diffusion?, **170**, 265.
Skumanich, A. See Athay and Skumanich, Thermalization Lengths and Mean Numbers of Scatterings for Line Photons, **170**, 605.
Slattery, Wayne L. See Hubbard and Slattery, Statistical Mechanics of Light Elements at High Pressure. I. Theory and Results for Metallic Hydrogen with Simple Screening, **168**, 131.
Smith, A. G. See Folsom et al., Optical Changes in Eleven Ohio Radio Sources with Unusual Spectra, **169**, L131.
Smith, Andrew M., and Stecher, Theodore P. Carbon Monoxide in the Interstellar Spectrum of Zeta Ophiuchi, **164**, L43.
Smith, D. F. Plasma Radiation from Collisionless MHD Shock Waves. I. Shock-Region Analysis, **170**, 559.
Smith, Harding E. See Spinrad et al., The Detection of the Galactic Nucleus at One Micron, **165**, 17.
Smith, Lindsey F., and Aller, Lawrence H. A Detailed Comparison of the Spectra of a Planetary Nucleus and a Wolf-Rayet Star, **164**, 275.
Smith, Malcolm G., and Weedman, Daniel W. Kinematic Properties of Seventy-One H II Regions in the Large Magellanic Cloud, **169**, 271.
Smith, M. W., and Wiese, W. L. Graphical Presentations of Systematic Trends of Atomic Oscillator Strengths along Isoelectronic Sequences and New Oscillator Strengths Derived by Interpolation, **166**, 451; Suppl., **23**, 103 (No. 196).
Smith, R. Connon. See Jackson et al., Stellar Rotation: A Comparison of Recent Results, **165**, 223.
Smith, William B. See Lewin et al., Detection of a High-Energy X-Ray Flare from a Source in Crux, **166**, L69.
Smith, William Hayden, Bromander, J., Curtis, L. J., Berry, H. G., and Buchta, R. Lifetime Measurements and Absolute Oscillator Strengths for Some Vacuum-Ultraviolet Transitions in O I and O II, **165**, 217.
Smoluchowski, R. Metallic Interiors and Magnetic Fields of Jupiter and Saturn, **166**, 435.
Snowden, Michael S. See Rosendhal and Snowden, A Search for Light Variations in Some Supergiants in the Large Magellanic Cloud, **169**, 281.
Snyder, Lewis E., and Buhl, David. Observations of Radio Emission from Interstellar Hydrogen Cyanide, **163**, L47.
Soderblom, David R. See Barker et al., Abundance Analyses of Population II Variable Stars. I. W Virginis, **165**, 67.
Soifer, Baruch T., Houck, J. R., and Harwit, Martin. Rocket-Infrared Observations of the Interplanetary Medium, **168**, L73.
Soifer, B. T. See Houck et al., Rocket-Infrared Four-Color Photometry of the Galaxy's Central Regions, **169**, L31.
Solomon, Philip, Jefferts, Keith B., Penzias, Arno A., and Wilson, Robert W. Observation of CO Emission at 2.6 Millimeters from IRC+10216, **163**, L53.
Solomon, P. M. See Burbidge et al., Apparent Associations between Bright Galaxies and Quasi-stellar Objects, **170**, 233.
———. See Jefferts et al., Detection of Interstellar Carbonyl Sulfide, **168**, L111.
———. See Penzias et al., Interstellar Carbon Monosulfide, **168**, L53.
———. See Wilson et al., Millimeter Observations of CO, CN, and CS Emission from IRC+10216, **169**, L35.
———. See Woolf et al., Origin of the Reported Millimeter Continuum in IRC+10216, **167**, L65.
Solomon, P. M., Jefferts, K. B., Penzias, A. A., and Wilson, R. W. Detection of Millimeter Emission Lines from Interstellar Methyl Cyanide, **168**, L107.
Solomon, P. M., and Werner, Michael W. Low-Energy Cosmic Rays and the Abundance of Atomic Hydrogen in Dark Clouds, **165**, 41.
Sommer, J. See Engelhardt and Sommer,

XUM

Observation of 2 ^{3}S-2 ^{3}P Transitions in the He I Isoelectronic Sequence, **167**, 201.

Southwick, Robert G. See Wolff et al., A Two-Component Model of the Quiet Solar Wind with Viscosity, Magnetic Field, and Reduced Heat Conduction, **165**, 181.

Soyumer, Tevfik. See Teske et al., Type III Solar Radio Bursts Accompanied by Soft X-Radiation in the Absence of Hα Flares, **165**, 615.

Spangenberg, W. See Hansen and Spangenberg, Pulsational Stability of Pure-Helium Stars of Low Mass, **163**, 653.

Spangenberg, William H. See Hansen and Spangenberg, Equilibrium and Pulsational Properties of the Lower Helium Main Sequence, **168**, 71.

Sparks, W. M. See Fischel and Sparks, Partition Functions in Ionizing Plasmas, **164**, 359.

———. See Fischel et al., On the Outer Layers of Model Moving Atmospheres, **163**, 649.

Spector, Nissan. New Low Even Levels of Singly Ionized Erbium (Er II), **167**, 205.

Spector, Nissan, and Held, S. Description of the Erbium Spectra in the Photographic Infrared, **167**, 193.

Speer, R. J. See Gabriel et al., Rocket Observations of the Ultraviolet Solar Spectrum during the Total Eclipse of 1970 March 7, **169**, 595.

Spiegel, E. A. See Ruderman and Spiegel, Galactic Wakes, **165**, 1.

Spiegel, Edward A. See Ingersoll and Spiegel, Temperature Variation and the Solar Oblateness, **163**, 375.

Spinrad, Hyron, Gunn, James E., Taylor, Benjamin J., McClure, Robert D., and Young, James W. Color Changes and Absorption-Line Variations over the Inner Disk of M31 and the Central Regions of M32 and NGC 4472, **164**, 11.

Spinrad, Hyron, Liebert, James, Smith, Harding E., Schweizer, Francois, and Kuhi, Leonard V. The Detection of the Galactic Nucleus at One Micron, **165**, 17.

Spinrad, Hyron, Sargent, W. L. W., Oke, J. B., Neugebauer, Gerry, Landau, Robert, King, Ivan R., Gunn, James E., Garmire, Gordon, and Dieter, Nannielou H. Maffei 1: A New Massive Member of the Local Group?, **163**, L25.

Spinrad, Hyron, and Taylor, Benjamin J. Scanner Abundance Studies. III. The Super-Metal-Rich Cluster NGC 6791, **163**, 303.

———. The Stellar Content of the Nuclei of Nearby Galaxies. I. M31, M32, and M81, **165**, 227; Suppl., **22**, 445 (No. 193).

Spitzer, Lyman, Jr. See Purcell and Spitzer, Orientation of Rotating Grains, **167**, 31.

Spitzer, Lyman, Jr., and Hart, Michael H. Random Gravitational Encounters and the Evolution of Spherical Systems. I. Method, **164**, 399.

———. Random Gravitational Encounters and the Evolution of Spherical Systems. II. Models, **166**, 483.

Sramek, R. A. A Measurement of the Gravitational Deflection of Microwave Radiation near the Sun, October 1970, **167**, L55.

Stachnik, Robert V. See Shu et al., On the Density-Wave Theory of Galactic Spirals. III. Comparisons with External Galaxies, **166**, 465.

Stecher, Theodore P. See Alexander et al., The Gum Nebula: Further Evidence from Spacecraft and Ground-based Instruments, **167**, 487.

———. See Brandt et al., The Gum Nebula: Fossil Strömgren Sphere of the Vela X Supernova, **163**, L99.

———. See Smith and Stecher, Carbon Monoxide in the Interstellar Spectrum of Zeta Ophiuchi, **164**, L43.

Steigman, Gary. See Field and Steigman, Charge Transfer and Ionization Equilibrium in the Interstellar Medium, **166**, 59.

Steigman, Gary, Werner, Michael W., and Geldon, Fred M. Ionization Equilibrium of Interstellar Nitrogen: A Probe for the Intercloud Medium?, **168**, 373.

Stein, Robert F. Reflection, Refraction, and Coupling of MHD Waves at a Density Step, **164**, 394; Suppl., **22**, 419 (No. 192).
Stein, W. A. See Dyck et al., Visual Intrinsic Polarization and Infrared Excess of Cool Stars, **165**, 57.
———. See Forrest et al., Variability of Radiation from Circumstellar Grains Surrounding R Coronae Borealis, **170**, L29.
———. See Gillett and Stein, Infrared Studies of Galactic Nebulae. II. B Stars Associated with Nebulosity, **164**, 77.
———. See Gillett et al., Infrared Studies of Galactic Nebulae. II. The Compact Nebulae IC 4997, VV 8, and FG Sagittae, **163**, L57.
———. See Gillett et al., Observations of Infrared Radiation from Cool Stars, **164**, 83.
Stibbs, D. W. N. The Greenhouse Effect in a Gray Planetary Atmosphere: An Exact Solution for the Emergent Radiation, **168**, 155.
Stobie, R. S. On the Difference between the Oosterhoff Types I and II Globular Clusters, **168**, 381.
Stoering, J. P. See Palmieri et al., Diffuse Cosmic X-Ray Flux from 0.2 to 2 keV, **169**, 33.
———. See Palmieri et al., Soft X-Rays from Two Supernova Remnants, **164**, 61.
———. See Seward et al., X-Rays from Puppis A and the Vicinity of Vela X, **169**, 515.
Stoker, P. H., and Carmichael, Hugh. Steplike Changes in the Long-Term Modulation of Cosmic Rays, **169**, 357.
Stone, R. G. See Fainberg and Stone, Hectometric Solar Noise Storms: Detection of Continuum, **164**, L123.
Stothers, Richard. See Chin and Stothers, Low-Mass White Dwarfs and the Cooling Sequences in the Hyades Clusters, **163**, 555.
Straka, W. C. A Determination of the Lower Mass Limit for the Main Sequence, **165**, 109.
———. An Examination of the Criterion for the Lower Mass Limit to the Main Sequence, **164**, 125.
Strauss, Federico M., and Papagiannis, Michael D. A Model for the Source of Solar-Flare X-Rays, **164**, 369.
Strecker, Donald W. See Humphreys et al., High-Luminosity G Supergiants, **167**, L35.
Strecker, D. W. See Becklin et al., Infrared Observations of the Core of Centaurus A, NGC 5128, **170**, L15.
Strittmatter, P. A. See Burbidge and Strittmatter, G61–29, A Helium Emission-Line Star, **170**, L39.
———. See Burbidge et al., Apparent Associations between Bright Galaxies and Quasi-stellar Objects, **170**, 233.
Strom, K. M., Strom, S. E., and Yost, J. Circumstellar Shells in the Young Cluster NGC 2264, **165**, 479.
Strom, S. E. See Strom et al., Circumstellar Shells in the Young Cluster NGC 2264, **165**, 479.
Strom, Stephen E. See Chaffee et al., Abundances in Open Clusters: Model-Atmosphere Abundance Analysis of Stars in the Pleiades and Hyades Clusters, **166**, 593.
Stuart, F. E. See Wallace et al., A Search for Deuterium on Venus, **168**, L29.
Stuart, Frank E. See Hudson et al., Automated and Conventional Photometry of the Short-Period Variable Star 14 Aurigae, **165**, 573.
Sturrock, P. A. A Model of Pulsars, **164**, 529.
———. On the Possibility of Pulsar Action in Quasars, **170**, 85.
———. The Period-Age Distribution of Pulsars, **169**, L7.
Sullivan, Woodruff T., III. Variations in Frequency and Intensity of 1.35-Centimeter H_2O Emission Profiles in Galactic H II Regions, **166**, 321.
Sullivan, W. T., III. See Johnston et al., An Interferometer Map of the Water-Vapor Sources in W49, **166**, L21.
———. See Johnston et al., Observations of 1.35-Centimeter H_2O Emission in the Southern Hemisphere, **167**, L93.
Sutherland, Peter. See Baym et al., The Ground State of Matter at High Densities: Equation of State and Stellar Models, **170**, 299.

XUM

Swedlund, John B. See Kemp et al., Confirmation of the Magnetic White Dwarf G−195−19, **164**, L17.
Sweigart, Allen V. A Method for Suppression of the Thermal Instability in Helium-Shell-Burning Stars, **168**, 79.
Swenson, G. W., Jr. See Rubin et al., Microwave Detection of Interstellar Formamide, **169**, L39.
Swift, C. D. See Price et al., X-Rays from the Magellanic Clouds, **168**, L7.
Swihart, T. L. See Pacholczyk and Swihart, Polarization of Radio Sources. III. Absorption Effects on Circular Polarization in a Synchrotron Source, **170**, 405.
Swings, J. P., and Allen, D. A. The Infrared Object HD 45677, **167**, L41.

Talbot, Raymond J., Jr. Nonlinear Pulsations of Unstable Massive Main-Sequence Stars. I. Small-Amplitude Tests of an Approximation Technique, **163**, 17.
———. Nonlinear Pulsations of Unstable Massive Main-Sequence Stars. II. Finite-Amplitude Stability, **165**, 121.
Talbot, Raymond J., Jr., and Arnett, W. David. The Evolution of Galaxies. I. Formulation and Mathematical Behavior of the One-Zone Model, **170**, 409.
Tammann, G. A. See Sandage and Tammann, Absolute Magnitudes of Cepheids. III. Amplitude as a Function of Position in the Instability Strip: A Period-Luminosity-Amplitude Relation, **167**, 293; Erratum, **170**, 191.
Tananbaum, H. See Giacconi et al., Discovery of Periodic X-Ray Pulsations in Centaurus X-3 from *Uhuru*, **167**, L67.
———. See Giacconi et al., An X-Ray Scan of the Galactic Plane from *Uhuru*, **165**, L27.
———. See Gursky et al., Detection of X-Rays from the Seyfert Galaxies NGC 1275 and NGC 4151 by the *Uhuru* Satellite, **165**, L43.
———. See Gursky et al., A Strong X-Ray Source in the Coma Cluster Observed by *Uhuru*, **167**, L81.
———. See Kellogg et al., X-Ray Observations of the Virgo Cluster, NGC 5128, and 3C 273 from the *Uhuru* Satellite, **165**, L49.
———. See Kellogg et al., X-Ray Sources near the Galactic Center Observed by *Uhuru*, **169**, L99.
———. See Leong et al., X-Ray Emission from the Magellanic Clouds Observed by *Uhuru*, **170**, L67.
———. See Oda et al., X-Ray Pulsations from Cygnus X-1 Observed from *Uhuru*, **166**, L1.
———. See Schreier et al., Further Observations of the Pulsating X-Ray Source Cygnus X-1 from *Uhuru*, **170**, L21.
Tananbaum, H., Gursky, H., Kellogg, E., and Giacconi, R. X-Ray Observations of GX 17+2 from *Uhuru*, **168**, L25.
Tananbaum, H., Kellogg, E., Gursky, H., Murray, S., Schreier, E., and Giacconi, R. Measurement of the Location of the X-Ray Sources Cygnus X-1 and Cygnus X-2 from *Uhuru*, **165**, L37.
Tarter, C. Bruce. Radiative Recombination Coefficients for Complex Ions, **168**, 313.
Tassoul, Jean-Louis, and Tassoul, Monique. Nonlinear Pulsations and Stability of Uniformly Rotating Spheroids, **166**, 621.
Tassoul, Monique. See Tassoul and Tassoul, Nonlinear Pulsations and Stability of Uniformly Rotating Spheroids, **166**, 621.
Tatum, J. B. Interpretation of Intensities in Diatomic Molecular Spectra, Erratum, **22**, 388.
Taylor, Benjamin J. Scanner Abundance Studies. II. Late G and K Dwarfs in the Solar Neighborhood, **165**, 675.
———. See Spinrad and Taylor, Scanner Abundance Studies. III. The Super-Metal-Rich Cluster NGC 6791, **163**, 303.
———. See Spinrad and Taylor, The Stellar Content of the Nuclei of Nearby Galaxies. I. M31, M32, and M81, **165**, 227; Suppl., **22**, 445 (No. 193).
———. See Spinrad et al., Color Changes and Absorption-Line Variations over the Inner Disk of M31 and the Central Regions of M32 and NGC 4472, **164**, 11.

Taylor, J. H. See Huguenin et al., Properties of Pulsars, **169**, 97.

Taylor, J. H., and Huguenin, G. R. Observations of Rapid Fluctuations of Intensity and Phase in Pulsar Emissions, **167**, 273.

Teegarden, B. See Baity et al., Intensities of Low-Energy Cosmic-Ray ^{2}H and ^{3}He Nuclei Measured in 1967-1968, **164**, 521.

Telford, L. E. See Kalaghan and Telford, Radio Observations of Mars at 8.57 Millimeters, **170**, L77.

Terzian, Yervant. The Galactic Nebula YM 29, **166**, 559.

Teske, Richard G., Soyumer, Tevfik, and Hudson, Hugh S. Type III Solar Radio Bursts Accompanied by Soft X-Radiation in the Absence of Hα Flares, **165**, 615.

Thaddeus, P. See Kutner and Thaddeus, 6-Centimeter Formaldehyde Absorption and Emission in the Orion Nebula, **168**, L67.

———. See Kutner et al., Observation of 140-GHz Formaldehyde Line Emission from the Trapezium Region of the Orion Nebula, **164**, L49.

———. See Tucker et al., Laboratory Measurement of the 6-Centimeter Formaldehyde Transitions, **169**, 429.

———. See Vanden Bout and Thaddeus, Lower Limit to the Interstellar $^{12}C/^{13}C$ Ratio in the Direction of 20 Tauri, **170**, 297.

———. See Wilson et al., Discovery of Interstellar Silicon Monoxide, **167**, L97.

Thaddeus, P., Wilson, R. W., Kutner, M., Penzias, A. A., and Jefferts, K. B. Discovery of Para-Formaldehyde and the 2-Millimeter Formaldehyde Distribution in the Orion Infrared Nebula, **168**, L59.

Thomas, R. M. See Davison et al., Weak X-Ray Sources in the Southern Hemisphere, **167**, 479.

Thomas, R. N. See Gebbie and Thomas, The Temperature Control Bracket, **168**, 461.

Thompson, A. R. See Hughes et al., An Absorption-Line Study of the Galactic Neutral Hydrogen at 21 Centimeters Wavelength, **168**, 579; Suppl., **23**, 323 (No. 200).

Thompson, Rodger I., Schnopper, Herbert W., and Rose, William K. Evidence for Hydrogen-to-Carbon Ratios in Accordance with the CNO Bi-Cycle in Several Carbon Stars, **163**, 533.

Thorne, Kip S., and Dykla, John J. Black Holes in the Dicke-Brans-Jordan Theory of Gravity, **166**, L35.

Thorne, Kip S., and Will, Clifford M. Theoretical Frameworks for Testing Relativistic Gravity. I. Foundations, **163**, 595.

Thornton, D. D. See Wrixon et al., The Spectrum of Jupiter at Millimeter Wavelengths, **169**, 171.

Tigelaar, H. L. See Rubin et al., Microwave Detection of Interstellar Formamide, **169**, L39.

Toevs, James W., Fowler, William A., Barnes, C. A., and Lyons, Peter B. Stellar Rates for the $^{28}Si(\alpha,\gamma)^{32}S$ and $^{16}O(\alpha,\gamma)^{20}Ne$ Reactions, **169**, 421.

Tomasevich, B. R. See Tucker et al., Laboratory Measurement of the 6-Centimeter Formaldehyde Transitions, **169**, 429.

Toor, A. See Price et al., X-Rays from the Magellanic Clouds, **168**, L7.

Toor, A., Price, R., Seward, F., and Scudder, J. X-Ray Source Positions for Cygnus X-1, Cygnus X-2, and Cygnus X-3, **168**, L15.

Torres-Peimbert, Silvia. See Peimbert and Torres-Peimbert, Planetary Nebulae. III. Chemical Abundances, **168**, 413.

Trafton, L. See Kovar et al., The Infrared Spectrum of IC 418, **170**, 449.

Trafton, Laurence M. See Wildey and Trafton, Studies of Jupiter's Equatorial Thermal Limb Darkening during the 1965 Apparition, **165**, 228; Suppl., **23**, 1 (No. 194); Erratum, **169**, 447; **23**, 321.

Traub, W., and Roesler, F. L. The Abundance of Lithium in Sunspots, **163**, 629.

Trehan, S. K. See Kochhar and Trehan, The Oscillations and the Stability of Rotating Masses with Toroidal Magnetic Fields. II, **168**, 265.

XUM

Trehan, S. K., and Billings, Dana F. On the Oscillations of a Magnetic Polytrope, **169**, 567.
Trentelman, G. F. See Austin et al., Energy of the Second Excited State of ^{12}C and the Rate of the Triple-Alpha Reaction, **163**, L79.
Treves, A. See Coppi and Treves, Plasma Model for Thermal X-Ray Sources, **167**, L9.
Trimble, Virginia, and Rees, Martin J. Runaway Stars and the Pulsars near the Crab Nebula (?), **166**, L85.
Trimble, Virginia, and Woltjer, Lodewyk, On the Mass of the Crab Nebula, **163**, L97.
Tripathi, A. N. See Mathur et al., Cross-Sections and Reaction Rates for Electron-Impact Ionization of Lithiumlike and Sodiumlike Positive Ions, **165**, 425.
Trümper, Manfred. Ellipsoidal Velocity Distributions and a Kinetic Theory of Newtonian Cosmological Models, **164**, 223.
Truran, J. W. See Arnett et al., Nucleosynthesis in Supernova Models. II. The ^{12}C Detonation Model, **165**, 87.
Tucker, K. D., Tomasevich, B. R., and Thaddeus, P. Laboratory Measurement of the 6-Centimeter Formaldehyde Transitions, **169**, 429.
Tucker, Wallace H. A Blast-Wave Model for the Vela X Supernova Remnant and the Origin of the Gum Nebula, **167**, L85.
Tucker, Wallace H., and Koren, Marvin. Radiation from a High-Temperature, Low-Density Plasma: The X-Ray Spectrum of the Solar Corona, **168**, 283; Erratum, **170**, 621.
Tull, Robert G. See Wagner et al., Spectrophotometry of Nova Serpentis 1970, **165**, 431.
Turner, Barry E. See Rubin and Turner, Observations of Compact H II Regions with Optical Counterparts, **165**, 471.
Turner, B. E. Detection of Interstellar Cyanoacetylene, **163**, L35.
———. See Morris et al., HCN in IRC+10216, **170**, L109.
———. See Zuckerman et al., New Ammonia Lines and Sources in the Galaxy, **169**, L105.
Turner, B. E., and Heiles, Carl. Nonthermal OH Emission in Interstellar Dust Clouds, **170**, 453.
Turner, B. E., and Rubin, R. H. New Galactic H_2O Sources Associated with H II Regions, **170**, L113.

Ulrich, Marie-Helene. Seyfert-Type Characteristics of the Nucleus of NGC 6814, **165**, L61.
Ulrich, Marie-Helene J. Spectrographic Observations of Twenty-eight Markarian Galaxies, **163**, 441.
Ulrich, Roger K. Evidence for ^3He in Young Open Clusters, **165**, L95.
———. Evolution of Stars Containing ^3He, **168**, 57.
———. See Bahcall and Ulrich, Solar Neutrinos. III. Composition and Magnetic-Field Effects and Related Inferences, **170**, 593.
Usher, P. D., Shen, B. S. P., and Barrett, J. W. I Zw 1: A Variable Compact Galaxy, **165**, 647.

Valley, George C. Propagation of Hydromagnetic Waves in a Stochastic Magnetic Field, **168**, 251.
van Altena, W. F. The Luminosity of the Magnetic White Dwarf AC+70°8247, **165**, L77.
Van Blerkom, David J. Diffuse Reflection from Clouds with Horizontal Inhomogeneities, **166**, 235.
———. Physical Parameters of Two Planetary Nebulae with Wolf-Rayet Nuclei, **166**, 343.
Vanden Bout, P., and Thaddeus, P. Lower Limit to the Interstellar $^{12}C/^{13}C$ Ratio in the Direction of 20 Tauri, **170**, 297.
Vandervoort, Peter O. Nonlinear Density Waves in Galaxies, **166**, 37.
Vasilevskis, S. On the Expansion of the Orion-Nebula Cluster, **167**, 537.
Velusamy, T. See Kundu and Velusamy, Polarization of Tycho's Supernova Remnant at a Wavelength of 2.8 Centimeters, **163**, 231.
Verschuur, G. L. Recent Measurements of

the Zeeman Effect at 21-Centimeter Wavelength, **165**, 651.
Veverka, J. See Elliot et al., A Search for an Optical Source at the Position of Centaurus XR-3, **168**, L95.
Vickers, Glenn T. On the Formation of Giant Cells and Supergranules, **163**, 363.
Vieira, Edemundo da Rocha. Maps of the Distribution of Atomic Hydrogen in a Region in Centaurus, **164**, 393; Suppl., **22**, 369 (No. 190).
Vila, Samuel C. Deuterium Burning as the Origin of the Outbursts of the Star HL Taurus 76, **163**, 543.
———. Evolution of a 0.6 $M_{\odot}$ White Dwarf, **170**, 153.
———. Late Evolution of Close Binaries, **168**, 217.
Visvanathan, N. See Kristian et al., On the Optical Identification of Cygnus X-1, **168**, L91.
Vitkevitch, V. V. See Kellermann et al., High-Resolution Observations of Compact Radio Sources at 6 and 18 Centimeters, **169**, 1.
Vokac, Peter R. See Hudson et al., Automated and Conventional Photometry of the Short-Period Variable Star 14 Aurigae, **165**, 573.

Wada, M. See Miyamoto et al., Measurement of the Location of the X-Ray Source Cygnus X-1, **168**, L11.
Wade, C. M. See Herrero et al., Radio Observations of Nova Scuti 1970, **166**, L19.
———. See Hjellming and Wade, Radio Emission from Antares B, **168**, L115.
———. See Hjellming and Wade, Radio Emission from X-Ray Sources, **168**, L21.
———. See Hjellming and Wade, The Radio Sources Associated with Scorpius X-1, **164**, L1.
Wade, C. M., and Hjellming, R. M. Detection of Radio Emission from Antares, **163**, L105.
———. Further Radio Observations of Novae, **163**, L65.
———. Further Radio Observations of Scorpius X-1, **170**, 523.
Wade, C. M., Hjellming, R. M., Kellermann, K. I., and Wardle, J. F. C. Radio Emission from the Nucleus of NGC 5128, **170**, L11.
Wagner, Raymond L., Tull, Robert G., Byrd, Gene G., and Loren, Robert B. Spectrophotometry of Nova Serpentis 1970, **165**, 431.
Wagner, William J., and House, Lewis L. Empirically Corrected Calculations of Coronal Visible Lines from the $3p^5\,3d$ Configuration, **166**, 683.
Wagoner, Robert V. See Bardeen and Wagoner, Relativistic Disks. I. Uniform Rotation, **167**, 359.
———. See Salpeter and Wagoner, Structure of Relativistic Disks, **164**, 557.
Walborn, Nolan R. On the Existence of OB Stars with Anomalous Nitrogen and Carbon Spectra, **164**, L67.
———. Some Extremely Early O Stars near Eta Carinae, **167**, L31.
———. Some Spectroscopic Characteristics of the OB Stars: An Investigation of the Space Distribution of Certain OB Stars and the Reference Frame of the Classification, **167**, 357; Suppl., **23**, 257 (No. 198).
Walborn, N. R. See Heeschen et al., The Distribution of Light in the Central Regions of Some Giant Elliptical Galaxies, **165**, L65.
Walker, A. B. C., Jr., and Rugge, H. R. Observation of Autoionizing States in the Solar Corona, **164**, 181.
Walker, G. A. H. See Hutchings et al., Ultrarapid Activity at Hα in the Spectra of Be Stars, **170**, L73.
Walker, Merle F. Electronographic Photometry of Star Clusters in the Magellanic Clouds. II. The Color-Magnitude Diagram of NGC 2209, **167**, 1.
Wallace, D. C. See Gordon and Wallace, Physical Characteristics of W49A as Determined from Radio Recombination Lines, **167**, 235.
Wallace, L., Stuart, F. E., Nagel, R. H., and Larson, M. D. A Search for Deuterium on Venus, **168**, L29.
Wallerstein, George. On the Infrared Excess of W Cephei and Similar Stars, **166**, 725.

Wallerstein, George. Spectroscopic Observations of VY Canis Majoris during 1969-1971, **169**, 195.
Wallerstein, George, and Silk, Joseph. Interstellar Gas in the Direction of the Vela Pulsar, **170**, 289.
Walters, G. K. See Predmore et al., Limiting ^{3}He Abundances in Four H II Regions, **168**, L125.
Wampler, E. Joseph. Photoelectric Spectrophotometry of Seyfert Galaxies, **164**, 1.
Wampler, Joseph. See Horowitz et al., Optical Time-of-Arrival Measurements from the Crab Pulsar: Comparison of Results from Four Observatories, **166**, L91.
Wang, C. G. See Lee et al., Properties of Hadron Matter. I. The Equation of State, **166**, 387.
———. See Leung and Wang, Properties of Hadron Matter. II. Dense Baryon Matter and Neutron Stars, **170**, 499.
Wardle, J. F. C. See Wade et al., Radio Emission from the Nucleus of NGC 5128, **170**, L11.
Wardle, J. F. C., and Miley, G. K. Radio Emission from Quasi-stellar Objects, **164**, L119.
Wares, G. W. See Wolnik et al., Measurements of Oscillator Strengths for Fe I and Fe II, **166**, L31.
Warner, John W., and Wing, Robert F. An Extraordinary Red Object in Sagittarius, **167**, L53.
Waters, J. W. See Barrett et al., Detection of Methyl Alcohol in Orion at a Wavelength of ~1 Centimeter, **168**, L101.
Watson, J. K. G. See Oka et al., Possible Rotational Equilibration of Interstellar Ammonia by Radiative $\Delta k = \pm 3$ Transitions, **165**, L15.
Watson, R. D. Atmospheric Abundances in the Beta Cephei Stars, **169**, 343.
———. The Variations in Beta Cephei Stars, **170**, 345.
Webber, W. R. See Baity et al., Intensities of Low-Energy Cosmic-Ray ^{2}H and ^{3}He Nuclei Measured in 1967-1968, **164**, 521.
Weber, Stephen V., Henry, Richard C., and Carruthers, George R. Far-Ultraviolet Interstellar Absorption in Orion and Monoceros, **166**, 543.
Weedman, Daniel W. On the Presence of [Fe X] and [Fe XIV] Emission in NGC 4151, **167**, L23.
———. See Khachikian and Weedman, A New Cloud of Hydrogen Emission in a Bright Galactic Nucleus, **164**, L109.
———. See Smith and Weedman, Kinematic Properties of Seventy-one H II Regions in the Large Magellanic Cloud, **169**, 271.
Wehinger, Peter. See Wyckoff and Wehinger, Minimum-Light Spectra of Mira Variables with Very Long Periods, **164**, 383.
Weiler, K. W., and Seielstad, G. A. Synthesis of the Polarization Properties of 3C 10 and 3C 58 at 1420 and 2880 MHz, **163**, 455.
Weinberg, Steven. Entropy Generation and the Survival of Protogalaxies in an Expanding Universe, **168**, 175.
Welch, Gary A. See Chincarini et al., A Supermassive Double Galaxy in the Cluster Abell 1775, **169**, 11.
———. See Rood and Welch, On the Origin of the Galactic Halo, **165**, 225.
Welch, Gary A., and Sastry, G. N. Photographic Detection of "Intergalactic" Matter in the Coma Cluster, **169**, L3.
Welch, Jack. See Lampton et al., Simultaneous Radio and Optical Measurements of Scorpius XR-1, **164**, L61.
Welch, W. J. See Johnston et al., An Interferometer Map of the Water-Vapor Sources in W49, **166**, L21.
———. See Wrixon et al., The Spectrum of Jupiter at Millimeter Wavelengths, **169**, 171.
Weliachew, L. Detection of Interstellar OH in Two External Galaxies, **167**, L47.
———. See Shostak and Weliachew, Hydrogen Line and Continuum Study of Maffei 2 by Radio Interferometry, **169**, L71.
Wentzel, Donat G. Acceleration and Heating of Interstellar Gas by Cosmic Rays, **163**, 503.
———. High-Speed Interstellar Gas Dynam-

ics: Shocks Moderated by Cosmic Rays, **170**, 53.
Werner, Michael W. See Hollenbach et al., Molecular Hydrogen in H I Regions, **163**, 165.
———. See Mather et al., A Search for Spectral Features in the Submillimeter Background Radiation, **170**, L59.
———. See Solomon and Werner, Low-Energy Cosmic Rays and the Abundance of Atomic Hydrogen in Dark Clouds, **165**, 41.
———. See Steigman et al., Ionization Equilibrium of Interstellar Nitrogen: A Probe for the Intercloud Medium?, **168**, 373.
Wertz, James R. A Newtonian Big-Bang Hierarchical Cosmological Model, **164**, 227.
Westphal, James A. See McCord and Westphal, Mars: Narrow-Band Photometry, from 0.3 to 2.5 Microns, of Surface Regions during the 1969 Apparition, **168**, 141.
Whaling, Ward. See Martinez-Garcia et al., Branching Ratios and Transition Probabilities in Fe I, **165**, 213.
Whang, Y. C. Conversion of Magnetic-Field Energy into Kinetic Energy in the Solar Wind, **169**, 369.
Wheeler, J. Craig. "Bootstrap" Equation of State for Cold Ultradense Matter, **169**, 105.
———. See Buchler et al., Thermonuclear Detonations in Evolved Stellar Cores, **167**, 465.
Whitford, A. E. Absolute Energy Curves and K-Corrections for Giant Elliptical Galaxies, **169**, 215.
Whittle, R. P. J. See Radhakrishnan et al., The Parkes Survey of 21-Centimeter Absorption in Discrete-Source Spectra. II. Galactic 21-Centimeter Observations in the Direction of 35 Extragalactic Sources, **170**, 617.
Widing, K. G., Sandlin, G. D., and Cowan, Robert D. On the Classification of Some Highly Ionized Iron and Nickel Lines in the 200-400 Å Region of the Solar Spectrum, **169**, 405.
Wiese, W. L. See Smith and Wiese, Graphical Presentations of Systematic Trends of Atomic Oscillator Strengths along Isoelectronic Sequences and New Oscillator Strengths Derived by Interpolation, **166**, 451; Suppl., **23**, 103 (No. 196).
Wiese, W. L., and Kelleher, D. E. On the Cause of the Redshifts in White-Dwarf Spectra, **166**, L59.
Wildey, R. L. Structure of the Jovian Disk in the ν_2-Band of Ammonia at 100000 Å, **164**, 395.
Wildey, Robert L., and Trafton, Laurence M. Studies of Jupiter's Equatorial Thermal Limb Darkening during the 1965 Apparition, **165**, 228; Suppl., **23**, 1 (No. 194); Erratum, **169**, 447; **23**, 321.
Wilkinson, David T. See Horowitz et al., Optical Time-of-Arrival Measurements from the Crab Pulsar: Comparison of Results from Four Observatories, **166**, L91.
Will, Clifford M. Relativistic Gravity in the Solar System. I. Effect of an Anisotropic Gravitational Mass on the Earth-Moon Distance, **165**, 409.
———. Relativistic Gravity in the Solar System. II. Anisotropy in the Newtonian Gravitational Constant, **169**, 141.
———. Theoretical Frameworks for Testing Relativistic Gravity. II. Parametrized Post-Newtonian Hydrodynamics, and the Nordtvedt Effect, **163**, 611.
———. Theoretical Frameworks for Testing Relativistic Gravity. III. Conservation Laws, Lorentz Invariance, and Values of the PPN Parameters, **169**, 125.
———. See Thorne and Will, Theoretical Frameworks for Testing Relativistic Gravity. I. Foundations, **163**, 595.
Williams, Robert E. The Helium Abundance in Quasi-stellar Objects, **167**, L27.
Wills, Beverley J. Daily and Hourly Variations in Flux Density of Radio Sources, **169**, 221.
Wills, Beverley J., Kraus, John D., and Andrew, Bryan H. Ohio Radio-Source Spectra: List II, **169**, L87.
Wilson, B. G. See Shukla and Wilson, Low-Energy Cosmic X-Rays, **164**, 265; Erratum, **168**, 319.

XUM

Wilson, James R. A Numerical Study of Gravitational Stellar Collapse, **163**, 209.

Wilson, R. See Gabriel et al., Rocket Observations of the Ultraviolet Solar Spectrum during the Total Eclipse of 1970 March 7, **169**, 595.

Wilson, Robert E. A Model of Epsilon Aurigae, **170**, 529.

Wilson, Robert E., and Devinney, Edward J. Realization of Accurate Close-Binary Light Curves: Application to MR Cygni, **166**, 605.

Wilson, Robert W. See Solomon et al., Observation of CO Emission at 2.6 Millimeters from IRC+10216, **163**, L53.

Wilson, R. W. See Jefferts et al., Detection of Interstellar Carbonyl Sulfide, **168**, L111.

———. See Kutner et al., Observation of 140-GHz Formaldehyde Line Emission from the Trapezium Region of the Orion Nebula, **164**, L49.

———. See Penzias et al., Interstellar Carbon Monosulfide, **168**, L53.

———. See Penzias et al., Interstellar $^{12}C^{16}O$, $^{13}C^{16}O$, and $^{12}C^{18}O$, **165**, 229.

———. See Solomon et al., Detection of Millimeter Emission Lines from Interstellar Methyl Cyanide, **168**, L107.

———. See Thaddeus et al., Discovery of Para-Formaldehyde and the 2-Millimeter Formaldehyde Distribution in the Orion Infrared Nebula, **168**, L59.

Wilson, R. W., Penzias, A. A., Jefferts, K. B., Kutner, M., and Thaddeus, P. Discovery of Interstellar Silicon Monoxide, **167**, L97.

Wilson, R. W., Solomon, P. M., Penzias, A. A., and Jefferts, K. B. Millimeter Observations of CO, CN, and CS Emission from IRC+10216, **169**, L35.

Wilson, William J. See Hardebeck and Wilson, Position Measurements of Main-Line OH/Infrared Stars, **169**, L123.

Wilson, W. J. Infrared Stars: Search for 3.5-Millimeter Radiation and Tentative Detection of VY Canis Majoris, **166**, L13.

Wing, Robert F. See Greene and Wing, A Brightening of the Ultraviolet Spectrum of the Carbon Star HD 59643, **163**, 309.

———. See Lockwood and Wing, Light Curves of Mira Variables at 1.04 Microns, **169**, 63.

———. See Warner and Wing, An Extraordinary Red Object in Sagittarius, **167**, L53.

Wofsy, S., Reid, R. H. G., and Dalgarno, A. Spin-Change Scattering of C II and O I by Atomic Hydrogen, **168**, 161.

Wolff, Charles L., Brandt, John C., and Southwick, Robert G. A Two-Component Model of the Quiet Solar Wind with Viscosity, Magnetic Field, and Reduced Heat Conduction, **165**, 181.

Wolnik, S. J., Berthel, R. O., and Wares, G. W. Measurements of Oscillator Strengths for Fe I and Fe II, **166**, L31.

Wolstencroft, Ramon D. See Kemp et al., Confirmation of the Magnetic White Dwarf G−195−19, **164**, L17.

Woltjer, Lodewyk. See Trimble and Woltjer, On the Mass of the Crab Nebula, **163**, L97.

Wood, K. See Cavaliere et al., On Quasar Evolution, **170**, 223.

Woodsworth, A. See Hughes et al., Radio Observations of Magnetic White Dwarfs, **170**, L125.

Woolf, N. J. See Cohen and Woolf, Two Young Bright Infrared Objects, **169**, 543.

———. See Dyck et al., Visual Intrinsic Polarization and Infrared Excess of Cool Stars, **165**, 57.

———. See Gehrz and Woolf, Mass Loss from M Stars, **165**, 285.

Woolf, N. J., Solomon, P. M., and Penzias, A. A. Origin of the Reported Millimeter Continuum in IRC+10216, **167**, L65.

Woosley, Stanford E. See Arnett et al., Nucleosynthesis in Supernova Models. II. The ^{12}C Detonation Model, **165**, 87.

Wray, James D. Highly Reddened Objects in Sagittarius, **168**, L97.

Wright, Melvyn C. H. On the Interpretation of Observations of Neutral Hydrogen in External Galaxies, **166**, 455.

Wrixon, G. T., Gott, J. Richard, III, and Penzias, A. A. Absolute Measurements of the Flux of Cassiopeia A and Taurus A at 1.87 Centimeters, **165**, 23.

Wrixon, G. T., Welch, W. J., and Thornton, D. D. The Spectrum of Jupiter at Millimeter Wavelengths, **169**, 171.

Wyckoff, Susan, and Wehinger, Peter. Minimum-Light Spectra of Mira Variables with Very Long Periods, **164**, 383.

York, Donald G. Structure in the Interstellar-Extinction Curve, **166**, 65.

Yost, J. See Strom et al., Circumstellar Shells in the Young Cluster NGC 2264, **165**, 479.

Yost, Jonathan C. See Shu et al., On the Density-Wave Theory of Galactic Spirals. III. Comparisons with External Galaxies, **166**, 465.

Young, Arthur, and Capps, Richard W. Hyades Membership of the White-Dwarf Eclipsing System BD+16°516, **166**, L81.

Young, A. T. Interpretation of Interplanetary Scintillations, **168**, 543.

Young, James W. See Spinrad et al., Color Changes and Absorption-Line Variations over the Inner Disk of M31 and the Central Regions of M32 and NGC 4472, **164**, 11.

Zaidins, Clyde S. See Hansen and Zaidins, The Rate of the $^{12}C + {}^{16}O$ Reaction, **168**, 317.

Zaumen, W. See Rappaport et al., GX 349+2 and GX 340+0: Locations and X-Ray Pulsation Limits, **169**, L93.

———. See Rappaport et al., On the Location of Cygnus X-1, **168**, L17.

———. See Rappaport et al., A Search for X-Ray Pulsations from Cygnus X-1, **168**, L43.

Zheleznyakov, V. V. On the Correct Form of the Equation of Radiative Transfer in a Nonuniform Magnetoactive Plasma, **168**, 281.

Zuckerman, B. See Morris et al., HCN in IRC+10216, **170**, L109.

Zuckerman, B., Ball, John A., and Gottlieb, Carl A. Microwave Detection of Interstellar Formic Acid, **163**, L41.

Zuckerman, B., Morris, M., Turner, B. E., and Palmer, Patrick. New Ammonia Lines and Sources in the Galaxy, **169**, L105.

XUM

XUM